APPENDIX A

SITE PHOTOGRAPHS
Photo 1 – View of the ambient air sample (SVI_AA02) located in the private outdoor space of Lot 30 (facing north).

Photo 2 – View of sub-slub vapor (SVI_SSV01) and co-located indoor air (SVI_IA01) samples located in the cellar in the northwestern part of the building on Lot 32 (facing west).
**Photo 3** – View of sub-slab vapor (SVI_SSV09) and co-located indoor air (SVI_IA09) samples located in the basement of the one-story supermarket in Lot 16 (facing north).

**Photo 4** – View of Langan performing a seal integrity test at sub-slab vapor (SVI_SSV04) located in the basement of the one-story supermarket in Lot 16 (facing down).
APPENDIX B

NYSDOH INDOOR AIR QUALITY QUESTIONNAIRE AND CHEMICAL PRODUCT INVENTORY
## Indoor Air Quality Investigation  
**Pre-Inspection Product Inventory**

**Site Name:** 2560-2580 Boston Road  
**Langan Project No.:** 170684201  
**Site Location:** Bronx, New York  
**Date:** 11/7/2023  
**Make and model of field instrument used:** ppbRAE

<table>
<thead>
<tr>
<th>Location</th>
<th>Product Description x Item Count</th>
<th>Size (units)</th>
<th>Condition*</th>
<th>Chemical Ingredients/Cas number</th>
<th>Field Instrument Reading (ppb)</th>
<th>Photo Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 16</td>
<td>Propane Tank x 1</td>
<td>10 Gal</td>
<td>U</td>
<td>Propane/(74-98-6)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Gasoline Tank x 9</td>
<td>5 Gal</td>
<td>U</td>
<td>Gasoline/(8006-61-9)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Minwax® Wood Finish x 2</td>
<td>1 Gal</td>
<td>U</td>
<td>Light Aliphatic Hydrocarbon/(64742-47-8), Heavy Naphthenic Petroleum Oil/(64742-52-5), Aliphatic Solvent/(64742-47-8), Med. Aliphatic Hydrocarbon Solvent/(64742-88-7), Mineral Spirits (Odorless)/(64742-48-9), 1,2,4-Trimethylbenzene/(95-63-6), Light Aromatic Hydrocarbons/(64742-95-6), Carbon Black/(1333-86-4), 1,3,5-Trimethylbenzene/(108-67-8), Xylene-mixed isomers/(1330-20-7)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Minwax® High-Build Polyurethane Wood Enamel/Gloss x 7</td>
<td>1 Qt</td>
<td>U</td>
<td>Light Aliphatic Hydrocarbon/(64742-47-8), Med. Aliphatic Hydrocarbon Solvent/(64742-88-7), Zirconium 2-Ethylhexanoate/(22464-99-9), Methyl Ethyl Ketoxime/(96-29-7)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Rust-Oleum® Painter's Touch Multi-Purpose Latex Paint Gloss x3</td>
<td>1 Qt</td>
<td>U</td>
<td>Titanium Dioxide/(13463-67-7), Dipropylene Glycol Monobutyl Ether/(29911-28-2), Ethanol/(H225), Oxirane, methyl-, polymer with oxirane, monobutyl ether/(H330), Sodium Nitrite/(7632-00-0), 5-Chloro-2-Methyl-4-Isothiazolin-3-one Mixture with 2-Methyl-4-Isothiazolin-3-one/(2682-20-4)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Rust-Oleum® Protective Enamel x1</td>
<td>1 Qt</td>
<td>U</td>
<td>Hydrotreated Light Distillate/(64742-47-8), Aluminum Flake/(7429-90-5), Petroleum Resin/(64742-16-1), Stoddard Solvent/(8052-41-3), Amorphous Precipitated Silica/(112926-00-8), Xylenes (o-, m-, p- Isomers)/(1330-20-7), Octadecylamine/(124-30-1), Cobalt 2-Ethylhexanoate/(136-52-7), Ethylbenzene/(100-41-4), Methyl Ethyl Ketoxime/(96-29-7)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Behr® Premium Interior Satin Cabinet &amp; Trim Enamel x1</td>
<td>1 Gal</td>
<td>U</td>
<td>Titanium Dioxide/(13463-67-7), Kaolin/(1332-58-7), 2-Methyl-2H-Isothiazolin-3-one/(2682-20-4)</td>
<td>0.0</td>
<td>Y</td>
</tr>
</tbody>
</table>

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D).
<table>
<thead>
<tr>
<th>Lot 30</th>
<th>Benjamin Moore® Premium Interior Latex Semi-Gloss Finish Base 4 x1</th>
<th>1 Qt</th>
<th>U</th>
<th>Titanium Dioxide/(13463-67-7), Kaolin/(1332-58-7)</th>
<th>0.0</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 30</td>
<td>Trewax® Wood Cleaner</td>
<td>32 fl oz</td>
<td>U</td>
<td>The exact percentage (concentration) of composition has been withheld as a trade secret There are no chemicals at reportable levels in this product meeting the OSHA and/or WHMIS definition of hazardous</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 30</td>
<td>Waterlox Original/Watco Danish Oil/Restor-A-Finish® Wood Oils x 5</td>
<td>1 Qt</td>
<td>U</td>
<td>Stoddard Solvent/(8052-41-3), Linseed Oil/(8001-26-1), Soybean Oil/(8001-22-7), Rosin Adduct Ester/(888888-09-3), Solvent Naphtha, Light Aromatic/(64742-95-6), Mineral Spirits/(64742-88-7)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Oatey® PVC and CPVC Purple Primer x 2</td>
<td>8 fl oz</td>
<td>U</td>
<td>Acetone/(67-64-1), Cyclohexanone/(108-94-1), Tetrahydro Furan/(109-99-9), Methyl ethyl ketone/(78-93-3)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Stainless Steal Cleaner x 9</td>
<td>18 fl oz</td>
<td>U</td>
<td>White mineral oil (petroleum)/(8042-47-5), Distillates (petroleum), hydrotreated light/(64742-47-8), Propane/(74-98-6)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Chain Oil X 3</td>
<td>32 fl oz</td>
<td>U</td>
<td>Heavy Hydrotreated Naphthenic Distillates (Petroleum)/(64742-52-5), Heavy Hydrotreated Paraffin Distillates/(64742-54-7), Tackifier Additive - Polymeric</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Gel Graffiti Remover x 6</td>
<td>18 fl oz</td>
<td>U</td>
<td>Butoxydiglycol/(112-34-5), d-Limonene/(5989-27-5), C9-11 Alcohols Ethoxylated/(68439-46-3)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>KleanStrip® Epoxy Thinners x 7</td>
<td>1 Gal</td>
<td>U</td>
<td>Acetone/(67-64-1), Xylene/(1330-20-7), Ethylbenzene/(100-41-4), Hydrotreated light distillate (petroleum)/(64742-47-8)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Bleach x 5</td>
<td>1 Gal</td>
<td>U</td>
<td>Sodium hypochlorite/(7681-52-9)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Hillyard® Assurance General Purpose Cleaner x 18</td>
<td>1 Gal</td>
<td>U</td>
<td>Sodium Carbonate/(497-19-8), Sodium metasilicate/(6834-92-0), Complex Surfactant Blend</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Hillyard 341 Seal®-finish x 18</td>
<td>1 Gal</td>
<td>U</td>
<td>Ethoxydiglycol/(111-90-0), Tributoxyethyl Phosphate/(78-51-3)</td>
<td>0.0</td>
<td>Y</td>
</tr>
<tr>
<td>Lot 32</td>
<td>Betco Advanced Alcohol Gel Sanitizer x 18</td>
<td>1 Gal</td>
<td>U</td>
<td>Ethanol/(64-17-5)</td>
<td>0.0</td>
<td>Y</td>
</tr>
</tbody>
</table>

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D).
NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer’s Name __________________________ Date/Time Prepared ____________________
Preparer’s Affiliation _______________________ Phone No. ________________________

Purpose of Investigation ________________________

1. OCCUPANT:

Interviewed: Y √

Last Name: ______________________ First Name: ______________________
Address: _______________________________________________________
County: _________________
Home Phone: _______________ Office Phone: _______________________

Number of Occupants/persons at this location _______ Age of Occupants ____________________

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y √

Last Name: ______________________ First Name: ______________________
Address: _______________________________________________________
County: _________________
Home Phone: _______________ Office Phone: _______________________

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential School ________________ Commercial/Multi-use √
Industrial Church ________________ Other: _______________________

Sub-Slab Soil Vapor Testing - Lot 16

Brian Kenneally
Environmental Consultant
(516) 282-6708

11/7/2023
If the property is residential, type? (Circle appropriate response)

- Ranch
- Raised Ranch
- Cape Cod
- Duplex
- Modular
- 2-Family
- Split Level
- Contemporary
- Apartment House
- Log Home
- 3-Family
- Colonial
- Mobile Home
- Townhouses/Condos
- Other: ________________

If multiple units, how many? ______

If the property is commercial, type?

- Business Type(s) ________________________________
  - Grocery Store

Does it include residences (i.e., multi-use)?  Y / N

If yes, how many? ______

Other characteristics:

- Number of floors ______
  - Building age ______ At least 57 years

Is the building insulated? Y / N

How air tight?  Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

There are two stairways leading from the first floor to the basement in the northern part of the building, allowing for airflow between the basement and first floor.

Airflow near source

The stairway in the northwest part of the building is about 20 feet north of sub-slab vapor sample SVI_SSV04.

Outdoor air infiltration

Outdoor air can infiltrate from the automatic sliding door entrance at the southwest corner of the building and the loading dock garage door in the western part of the site.

Infiltration into air ducts

Infiltration is possible through the building’s air conditioning.
5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction: wood frame, concrete, stone, brick

b. Basement type: full, crawlspace, slab, other ________

c. Basement floor: concrete, dirt, stone, other ________

d. Basement floor: uncovered, covered, covered with ________________

e. Concrete floor: unsealed, sealed, sealed with Partially with observed paint

f. Foundation walls: poured, block, stone, other ________

g. Foundation walls: unsealed, sealed, sealed with Painted

h. The basement is: wet, damp, dry, moldy

i. The basement is: finished, unfinished, partially finished

j. Sump present? Y □ N

k. Water in sump? Y / N / not applicable

Basement/Lowest level depth below grade: 15 feet

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)
Floor drains in basement, no major cracks.

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation, Heat pump, Hot water baseboard
Space Heaters, Stream radiation, Radiant floor
Electric baseboard, Wood stove, Outdoor wood boiler, Other ________

The primary type of fuel used is:

Natural Gas, Fuel Oil, Kerosene
Electric, Propane, Solar
Wood, Coal, Unknown

Domestic hot water tank fueled by: ________________

Boiler/furnace located in: Basement, Outdoors, Main Floor, Other Unknown

Air conditioning: Central Air, Window units, Open Windows, None
Are there air distribution ducts present?  Y  N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

Air ducts not observed in basement

7. OCCUPANCY

Is basement/lowest level occupied?  Full-time  Occasionally  Seldom  Almost Never

<table>
<thead>
<tr>
<th>Level</th>
<th>General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement</td>
<td>Grocery store product storage.</td>
</tr>
<tr>
<td>1st Floor</td>
<td>Grocery store.</td>
</tr>
<tr>
<td>2nd Floor</td>
<td></td>
</tr>
<tr>
<td>3rd Floor</td>
<td></td>
</tr>
<tr>
<td>4th Floor</td>
<td></td>
</tr>
</tbody>
</table>

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage?  Y  N

b. Does the garage have a separate heating unit?  Y / N  (NA)

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car)?  Y / N  (NA)  Please specify__________________

d. Has the building ever had a fire?  Unknown  Y / N  When?_________________

e. Is a kerosene or unvented gas space heater present?  Y  N  Where?_____________

f. Is there a workshop or hobby/craft area?  Y  N  Where & Type?_________________

g. Is there smoking in the building?  Y  N  How frequently?_________________

h. Have cleaning products been used recently?  Y  N  When & Type?_________________

i. Have cosmetic products been used recently?  Y  N  When & Type?_________________
j. Has painting/staining been done in the last 6 months? Y N Where & When? ____________
k. Is there new carpet, drapes or other textiles? Y N Where & When? ________________
l. Have air fresheners been used recently? Y N When & Type? ________________
m. Is there a kitchen exhaust fan? Y N If yes, where vented? ____________
n. Is there a bathroom exhaust fan? Y N If yes, where vented? ______________
o. Is there a clothes dryer? Y N If yes, is it vented outside? Y / N
p. Has there been a pesticide application? Y N When & Type? ________________

Are there odors in the building? Y N
If yes, please describe: ______________________________________________________________

Do any of the building occupants use solvents at work? Y / N Unknown
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist
If yes, what types of solvents are used? ________________
If yes, are their clothes washed at work? Y N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)
Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y N Date of Installation: ____________
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: _______
Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: _______

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: NA

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.
NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer’s Name __________________________ Date/Time Prepared ______________
Preparer’s Affiliation __________________________ Phone No. __________________

Purpose of Investigation________________________________________________________

1. OCCUPANT:

Interviewed: Y / N

Last Name: ___________________________ First Name: ___________________________
Address: ________________________________
County: ___________________________
Home Phone: __________________ Office Phone: __________________

Number of Occupants/persons at this location _______ Age of Occupants ________________________

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: ___________________________ First Name: ___________________________
Address: ________________________________
County: ___________________________
Home Phone: __________________ Office Phone: __________________

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential      School      Commercial/Multi-use
Industrial      Church      Other: Residential (Currently Vacant)
If the property is residential, type? (Circle appropriate response)

- Ranch
- Raised Ranch
- Cape Cod
- Duplex
- Modular
- 2-Family
- Split Level
- Contemporary
- Apartment House
- Log Home
- 3-Family
- Colonial
- Mobile Home
- Townhouses/Condos
- Other:_______________

If multiple units, how many? ______

If the property is commercial, type?
- Vacant

Business Type(s) _____________________________________

Does it include residences (i.e., multi-use)?   Y / N   If yes, how many? ______

Other characteristics:
- Number of floors 2   Building age 94 years
- Is the building insulated? Y / N   How air tight?  Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors
There is one stairway allowing for airflow between the basement and first floor.

Airflow near source
The stairway in the northwest part of the building is about 20 feet south of sub-slab vapor sample SVI_SSV03.

Outdoor air infiltration
Outdoor air can infiltrate from the garage door in the eastern part of the site and basement windows.

Infiltration into air ducts
No air ducts observed.
5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:  
   - wood frame  
   - concrete  
   - stone  
   - brick

b. Basement type:  
   - full  
   - crawlspace  
   - slab  
   - other ______

c. Basement floor:  
   - concrete  
   - dirt  
   - stone  
   - other ______

d. Basement floor:  
   - uncovered  
   - covered  
   - covered with ____________

e. Concrete floor:  
   - unsealed  
   - sealed  
   - sealed with ____________

f. Foundation walls:  
   - poured  
   - block  
   - stone  
   - other ______

g. Foundation walls:  
   - unsealed  
   - sealed  
   - sealed with ____________

h. The basement is:  
   - wet  
   - damp  
   - dry  
   - moldy

i. The basement is:  
   - finished  
   - unfinished  
   - partially finished

j. Sump present?  
   - Y  
   - N

k. Water in sump?  
   - Y  
   - N  
   - not applicable

Basement/Lowest level depth below grade:  

   __________(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

   - Hot air circulation  
   - Space Heaters  
   - Electric baseboard  
   - Heat pump  
   - Stream radiation  
   - Wood stove  
   - Hot water baseboard  
   - Radiant floor  
   - Outdoor wood boiler  
   - Other  

The primary type of fuel used is:

   - Natural Gas  
   - Fuel Oil  
   - Electric  
   - Propane  
   - Wood  
   - Coal  
   - Kerosene  
   - Solar  

   Unknown

   Unknown

Domestic hot water tank fueled by:  

Boiler/furnace located in:  

   - Basement  
   - Outdoors  
   - Main Floor  
   - Other  

Air conditioning:

   - Central Air  
   - Window units  
   - Open Windows  

   None
Are there air distribution ducts present?  

Y  N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

Air ducts not observed in basement

7. OCCUPANCY

Is basement/lowest level occupied?  
Full-time  Occasionally  Seldom  Almost Never

<table>
<thead>
<tr>
<th>Level</th>
<th>General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement</td>
<td>The building is currently vacant, however the owner uses the cellar space of the building for storage and for wood working</td>
</tr>
<tr>
<td>1st Floor</td>
<td></td>
</tr>
<tr>
<td>2nd Floor</td>
<td></td>
</tr>
<tr>
<td>3rd Floor</td>
<td></td>
</tr>
<tr>
<td>4th Floor</td>
<td></td>
</tr>
</tbody>
</table>

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage?  
Y  N

b. Does the garage have a separate heating unit?  
Y  N  NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car)  
Y  N  NA  Please specify__________________

d. Has the building ever had a fire?  
Unknown  Y  N  When?__________________

e. Is a kerosene or unvented gas space heater present?  
Y  N  Where?__________________

f. Is there a workshop or hobby/craft area?  
Y  N  Where & Type?  Woodworking shop in western part of the building's cellar

g. Is there smoking in the building?  
Y  N  How frequently?__________________

h. Have cleaning products been used recently?  
Y  N  When & Type?__________________
i. Have cosmetic products been used recently?  
Y  N  When & Type?__________________
j. Has painting/staining been done in the last 6 months? Y N Where & When? _______________

k. Is there new carpet, drapes or other textiles? Y N Where & When? _______________

l. Have air fresheners been used recently? Y N When & Type? _______________

m. Is there a kitchen exhaust fan? Y N If yes, where vented? _______________

n. Is there a bathroom exhaust fan? Y N If yes, where vented? _______________

o. Is there a clothes dryer? Y N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y N When & Type? _______________

Are there odors in the building? Y N
If yes, please describe: ______________________________________________________________

Do any of the building occupants use solvents at work? Y N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used? _______________
If yes, are their clothes washed at work? Y N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y N Date of Installation: ____________
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: _______
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10. RELOCATION INFORMATION (for oil spill residential emergency)

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Preparer’s Affiliation ____________________________ Phone No. ______________
Purpose of Investigation ____________________________

1. OCCUPANT:

Interviewed: Y N

Last Name: ___________________________ First Name: ___________________________
Address: _______________________________________________________________
County: __________________________
Home Phone: __________________ Office Phone: __________________
Number of Occupants/persons at this location ______ Age of Occupants _______________________

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y N

Last Name: ___________________________ First Name: ___________________________
Address: _______________________________________________________________
County: __________________________
Home Phone: __________________ Office Phone: __________________

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential School Commercial/Multi-use
Industrial Church Other: ___________________________
If the property is residential, type? (Circle appropriate response)

- Ranch
- Raised Ranch
- Cape Cod
- Duplex
- Modular
- 2-Family
- Contemporary
- Apartment House
- Log Home
- 3-Family
- Colonial
- Mobile Home
- Townhouses/Condos
- Other: _______________

If multiple units, how many? ______

If the property is commercial, type?

- Business Type(s) ____________________________

  Commercial Office

Does it include residences (i.e., multi-use)?   Y / N  

If yes, how many? ______

Other characteristics:

- Number of floors 1  
- Building age 89 years

- Is the building insulated? Y / N  
  How air tight?  Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

There is one hatch between the partial basement and first floor. It is typically closed.

_________________________________________________________________________________________________

Airflow near source

Sub-slab vapor sample SVI_SSV02 located next to roll-up garage door (closed during sampling).

_________________________________________________________________________________________________

Outdoor air infiltration

Outdoor air can infiltrate from the garage door in the eastern part of the site and basement windows.

_________________________________________________________________________________________________

Infiltration into air ducts

No air ducts observed.

_________________________________________________________________________________________________
5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction: [wood frame] concrete stone brick
b. Basement type: full [crawlspace] slab other ________
c. Basement floor: concrete dirt stone other ________
d. Basement floor: uncovered covered covered with ____________
e. Concrete floor: unsealed sealed sealed with ____________
f. Foundation walls: poured block stone other ________
g. Foundation walls: unsealed sealed sealed with ____________
h. The basement is: wet damp [dry] moldy
i. The basement is: finished unfinished partially finished
j. Sump present? Y [N]
k. Water in sump? Y / N / not applicable

Basement/Lowest level depth below grade: 6 (feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Soil observed on basement floor on top of concrete.

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

- Hot air circulation
- Space Heaters
- Electric baseboard
- Heat pump
- Stream radiation
- Wood stove
- Hot water baseboard
- Radiant floor
- Outdoor wood boiler
- Other Unknown

The primary type of fuel used is:

- Natural Gas
- Fuel Oil
- Electric
- Propane
- Wood
- Kerosene
- Solar
- Coal
- Unknown

Domestic hot water tank fueled by: ________________________________

Boiler/furnace located in: Basement Outdoors Main Floor Other Unknown

Air conditioning: Central Air Window units Open Windows None
Are there air distribution ducts present?  Y  

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

Air ducts not observed in basement or garage.

7. OCCUPANCY

Is basement/lowest level occupied?  Full-time  Occasionally  Seldom  Almost Never

<table>
<thead>
<tr>
<th>Level</th>
<th>General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement</td>
<td>Crawlspace.</td>
</tr>
<tr>
<td>1st Floor</td>
<td>Office space.</td>
</tr>
<tr>
<td>2nd Floor</td>
<td></td>
</tr>
<tr>
<td>3rd Floor</td>
<td></td>
</tr>
<tr>
<td>4th Floor</td>
<td></td>
</tr>
</tbody>
</table>

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage?  Y  N

b. Does the garage have a separate heating unit?  Y  N  NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car)  Y  N  NA

Please specify  Lawnmower, Snow blower.

d. Has the building ever had a fire?  Unknown  Y  N  When? ________________

e. Is a kerosene or unvented gas space heater present?  Y  N  Where? ________________

f. Is there a workshop or hobby/craft area?  Y  N  Where & Type? ________________

g. Is there smoking in the building?  Y  N  How frequently? ________________

h. Have cleaning products been used recently?  Y  N  When & Type? ________________

i. Have cosmetic products been used recently?  Y  N  When & Type? ________________
j. Has painting/staining been done in the last 6 months? Y N Where & When? _______________

k. Is there new carpet, drapes or other textiles? Y N Where & When? _______________

l. Have air fresheners been used recently? Y N When & Type? _______________

m. Is there a kitchen exhaust fan? Y N If yes, where vented? _______________

n. Is there a bathroom exhaust fan? Y N If yes, where vented? _______________

o. Is there a clothes dryer? Y N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y N When & Type? _______________

Are there odors in the building? Y N
If yes, please describe: ______________________________________________________________

Do any of the building occupants use solvents at work? Y / N Unknown
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)
If yes, what types of solvents are used? _______________
If yes, are their clothes washed at work? Y N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly)
Yes, use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service

Unknown

Is there a radon mitigation system for the building/structure? Y N Date of Installation: ____________
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: _______

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: _______

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: NA

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel
c. Responsibility for costs associated with reimbursement explained? Y / N
d. Relocation package provided and explained to residents? Y / N
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.
APPENDIX C

SUB-SLAB VAPOR AND INDOOR AIR CONSTRUCTION AND SAMPLING LOGS
### Sub-slab Soil Vapor Sampling Log Sheet

**Sample Number:** SVI_SSV01_110823

**Project:** 2560-2580 Boston Road

**Drilling Firm or Langan Installer:** Brian Kenneally

**Installation Equipment:** Bosch Rotary Hammer Drill

**Sample Date Started:** 11/7/2023

**Sample Date Finished:** 11/8/2023

**Sampler:** Brian Kenneally

**Regulator Flow Rate (L/min):** 0.0045

**Volume of Sample (Liters):** 1.926

**Sample Moisture Content:** N/A

**Can Serial Number:** 2776

**Regulator Serial Number:** 1372

**Can Start Vacuum Pressure (" HG):** -30.26

**Can Stop Vacuum Pressure (" HG):** -6.71

---

**Tubing Type/Diameter:** 3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing

**Type of Material Above Seal:** N/A

**Implant Screen Type/Length/Diameter:** None

**Borehole Diameter:** 1/2-inch

**Implant/Probe Details (Seal, Filter, etc.):**

<table>
<thead>
<tr>
<th>Heat Test</th>
<th>Pre-sampling</th>
<th>Post-sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELIUM TEST IN TUBE (%)</td>
<td>17.4%</td>
<td>16.3%</td>
</tr>
</tbody>
</table>

**Surface Details:**

- **Survey Elevation and Datum:** N/A
- **Surface Datum:** N/A
- **Surface Details:** None

**Surface Details:**

- **Surface Datum:** N/A
- **Surface Details:** None

**Installation Details:**

- **Depth:** Top of Seal 0.0
- **Notes:**

---

**Method of Installation and Purging:**

Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

---

**Notes:**

- See Sample Location Plan

---

**Inspector:** Brian Kenneally

**Sampler:** Brian Kenneally

**Potential Sample Interferences:**

See Chemical Product Inventory in Appendix B

**Weather Conditions (Precip., Temp., Press., Wind Speed and Dir.):**

- **Temp:** 42 - 52 Degrees Fahrenheit
- **Wind:** N 6 mph
- **Precipitation:** None
- **Pressure:** 30.35 inHg

**Installation Foreman:** Brian Kenneally

**Installation Date Started:** 11/7/2023

**Installation Date Finished:** 11/8/2023

**Sample Date Started:** 11/7/2023

**Sample Date Finished:** 11/8/2023

**Wind:** N 6 mph

**Precipitation:** None

**Pressure:** 30.35 inHg

---

**Sub-slab Soil Vapor Sampling Log Sheet**

**Sample Date Started:** 11/7/2023

**Sample Date Finished:** 11/8/2023

**Sampler:** Brian Kenneally

**Regulator Flow Rate (L/min):** 0.0045

**Volume of Sample (Liters):** 1.926

**Sample Moisture Content:** N/A

**Can Serial Number:** 2776

**Regulator Serial Number:** 1372

**Can Start Vacuum Pressure (" HG):** -30.26

**Can Stop Vacuum Pressure (" HG):** -6.71

---

**Sample Location Sketch**

<table>
<thead>
<tr>
<th>Tube Depth</th>
<th>2</th>
</tr>
</thead>
</table>

**Notes:**

See Sample Location Plan

---

**Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.**

21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.
**SUB-SLAB SOIL VAPOR SAMPLING LOG SHEET**

Sample Number: SVI_SSV03_110823

**PROJECT:** 2560-2580 Boston Road  
**PROJECT NO.:** 170684201

**LOCATION:** Bronx, NY  
**SURFACE ELEVATION AND DATUM:** N/A

**DRILLING FIRM OR LANGAN INSTALLER:** Brian Kenneally  
**INSTALLATION DATE STARTED:** 11/7/2023  
**DATE FINISHED:** 11/7/2023

**INSTALLATION FOREMAN:** Brian Kenneally  
**SAMPLE DATE STARTED:** 11/9/2023  
**DATE FINISHED:** 11/9/2023

**INSTALLATION EQUIPMENT:** Bosch Rotary Hammer Drill  
**TYPE OF SAMPLING DEVICE:** 2.7-Liter Summa Canister

**INSPECTOR:** Brian Kenneally  
**SAMPLER:** Brian Kenneally

**METHOD OF INSTALLATION AND PURGING:**
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

---

**TUBING TYPE/DIAMETER:** 3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing  
**TYPE OF MATERIAL ABOVE SEAL:** N/A

**IMPLANT SCREEN TYPE/LENGTH/DIAMETER:** None  
**SEAL MATERIAL (Bentonite, Beeswax, Modeling Clay, etc.):** Bentonite

**BOREHOLE DIAMETER:** 1/2-inch  
**FILTER PACK MATERIAL (Sand or Glass Beads):** None

**PURGE VOLUME (L):** N/A  
**REGULATOR FLOW RATE (L/MIN):** 0.0045  
**VOLUME OF SAMPLE (LITERS):** 2.115

**PURGE FLOW RATE (ML/MIN):** N/A  
**PID AFTER PURGE (PPM):** 0.0  
**SAMPLE MOISTURE CONTENT:** N/A

**HELUM TEST IN BUCKET (%):** 17.3%  
**TOP OF SEAL:** 0.0

**HELIUM TEST IN TUBE (PPM):** 16.8%  
**TOP OF PACK:** 0.0

**SAMPLE START TIME:** 8:19  
**SAMPLE STOP TIME:** 16:09  
**TOTAL SAMPLE TIME (MIN):** 470

**HELIUM TEST IN TUBE (PPM):** 3.0%  
**CAN SERIAL NUMBER:** 1952

**PID AFTER SAMPLE (PPM):** 0.0  
**REGULATOR SERIAL NUMBER:** 2249

**SAMPLE LOCATION SKETCH**

See Sample Location Plan

---

See Chemical Product Inventory in Appendix B

**WEATHER CONDITIONS (PRECIP., TEMP., PRESS., WIND SPEED AND DIR.:**
- Temp: 40 - 59 Degrees Fahrenheit
- Wind: SE 4 mph
- Precipitation: None
- Pressure: 30.35 inHg

---

**POTENTIAL SAMPLE INTERFERENCES:**

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**NOTES**

---

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.  
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
**SUB-SLAB SOIL VAPOR SAMPLING LOG SHEET**

**Sample Number:** SVI_SSV04_110823

**PROJECT:**
2560-2580 Boston Road

**PROJECT NO.:**
170684201

**LOCATION:**
Bronx, NY

**SURFACE ELEVATION AND DATUM:**
N/A

**DRILLING FIRM OR LANGAN INSTALLER:**
Brian Kenneally

**INSTALLATION DATE STARTED:**
11/7/2023

**DATE FINISHED:**
11/8/2023

**INSTALLATION FOREMAN:**
Brian Kenneally

**SAMPLE DATE STARTED:**
11/8/2023

**DATE FINISHED:**
11/8/2023

**INSTALLATION EQUIPMENT:**
Bosch Rotary Hammer Drill

**TYPE OF SAMPLING DEVICE:**
2.7-Liter Summa Canister

**INSPECTOR:**
Brian Kenneally

**SAMPLE DATE STARTED:**
11/8/2023

**DATE FINISHED:**
11/8/2023

**SAMPLER:**
Brian Kenneally

**POTENTIAL SAMPLE INTERFERENCES:**
See Chemical Product Inventory in Appendix B

**WEATHER CONDITIONS (PRECIP., TEMP., PRESS., WIND SPEED AND DIR.):**
- Temp: 42 - 52 Degrees Fahrenheit
- Wind: N 6 mph
- Precipitation: None
- Pressure: 30.35 inHg

**METHOD OF INSTALLATION AND PURGING:**
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

**TUBING TYPE/DIAMETER:**
3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing

**TYPE OF MATERIAL ABOVE SEAL:**
N/A

**IMPLANT SCREEN TYPE/LENGTH/DIAMETER:**
None

**SEAL MATERIAL (Bentonite, Beeswax, Modeling Clay, etc.):**
Bentonite

**BOREHOLE DIAMETER:**
1/2-inch

**FILTER PACK MATERIAL (Sand or Glass Beads):**
None

**PURGE VOLUME (L):**
N/A

**PURGE FLOW RATE (ML/MIN):**
N/A

**HELIUM TEST IN BUCKET (%):**
Pre-sampling: 17.1%
Post-sampling: 15.7%

**TOTAL SAMPLE TIME (MIN):**
447

**REGULATOR FLOW RATE (L/MIN):**
0.0045

**VOLUME OF SAMPLE (LITERS):**
2.0115

**PID AFTER SAMPLE (PPM):**
0.0

**SAMPLE MOISTURE CONTENT:**
N/A

**CAN SERIAL NUMBER:**
390

**REGULATOR SERIAL NUMBER:**
256

**CAN START VACUUM PRESS. (" HG):**
-30.08

**CAN STOP VACUUM PRESS. (" HG):**
-5.45

**NOTES:**
See Sample Location Plan

---

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

### Method of Installation and Purging:

**Tubing Type/Diameter:** 3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing

**Implant Screen Type/Length/Diameter:** None

**Boreshole Diameter:** 1/2-inch

**Purge Flow Rate (ML/Min):** N/A

**Purge Volume (L):** N/A

**PID After Purge (PPM):** 0

**Hehelium Test in Tube (PPM):** N/A

**Sample Start Time:** 8:28

**Sample Stop Time:** 15:54

**Total Sample Time (Min):** 446

**Regulator Flow Rate (L/Min):** 0.0045

**Volume of Sample (Liters):** 2.007

**PID After Sample (PPM):** 0.0

**Sample Moisture Content:** N/A

**Can Serial Number:** 2583

**Regulator Serial Number:** 29

**Can Start Vacuum Press. (" HG):** -30.28

**Can Stop Vacuum Press. (" HG):** -4.59

**Sample Location Sketch**

- Tube Depth: 2
**SUB-SLAB SOIL VAPOR SAMPLING LOG SHEET**
Sample Number: SVI_SSV06_110823

<table>
<thead>
<tr>
<th>HELIUM TESTS</th>
<th>HELIUM TEST IN BUCKET (%)</th>
<th>HELIUM TEST IN TUBE (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-sampling</td>
<td>Post-sampling</td>
</tr>
<tr>
<td>SAMPLE START TIME</td>
<td>8:56</td>
<td>2.7-Liter Summa Canister</td>
</tr>
<tr>
<td>SAMPLE STOP TIME</td>
<td>16:06</td>
<td>Top of Seal</td>
</tr>
<tr>
<td>TOTAL SAMPLE TIME (MIN)</td>
<td>430</td>
<td>Top of Pack</td>
</tr>
<tr>
<td>REGULATOR FLOW RATE (L/MIN)</td>
<td>0.0045</td>
<td>1.935</td>
</tr>
<tr>
<td>VOLUME OF SAMPLE (LITERS)</td>
<td>1.935</td>
<td>N/A</td>
</tr>
<tr>
<td>PID AFTER SAMPLE (PPM)</td>
<td>0.0</td>
<td>N/A</td>
</tr>
<tr>
<td>SAMPLE MOISTURE CONTENT</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>CAN SERIAL NUMBER</td>
<td>940</td>
<td>N/A</td>
</tr>
<tr>
<td>REGULATOR SERIAL NUMBER</td>
<td>279</td>
<td>N/A</td>
</tr>
<tr>
<td>CAN START VACUUM PRESS. (&quot; HG)</td>
<td>-30.54</td>
<td>N/A</td>
</tr>
<tr>
<td>CAN STOP VACUUM PRESS. (&quot; HG)</td>
<td>-5.8</td>
<td>N/A</td>
</tr>
<tr>
<td>Tube Depth</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**METHOD OF INSTALLATION AND PURGING:**
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

**TUBING TYPE/ DIAMETER:**
3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing

**TYPE OF MATERIAL ABOVE SEAL:**
N/A

**IMPLANT SCREEN TYPE/ LENGTH/ DIAMETER:**
1/2-inch

**FILTER PACK MATERIAL (Sand or Glass Beads):**
None

**IMPLANT PROBE DETAILS**

<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SURFACE</strong></td>
</tr>
<tr>
<td>Top of Seal</td>
</tr>
<tr>
<td>Top of Pack</td>
</tr>
<tr>
<td>Tube Depth</td>
</tr>
</tbody>
</table>

**METHOD OF INSTALLATION AND PURGING:**

**NOTES**

See Sample Location Plan
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.
## Sample Location Sketch

![Sample Location Sketch](image)

### Notes

See Sample Location Plan

---

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.

21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
<table>
<thead>
<tr>
<th>PROJECT: 2560-2580 Boston Road</th>
<th>PROJECT NO.: 170684201</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION: Bronx, NY</td>
<td>SURFACE ELEVATION AND DATUM: N/A</td>
</tr>
<tr>
<td>DRILLING FIRM OR LANGAN INSTALLER: Brian Kenneally</td>
<td>INSTALLATION DATE STARTED: 11/7/2023</td>
</tr>
<tr>
<td>INSTALLATION FOREMAN: Brian Kenneally</td>
<td>DATE FINISHED: 11/7/2023</td>
</tr>
<tr>
<td>INSTALLATION EQUIPMENT: Bosch Rotary Hammer Drill</td>
<td>SAMPLE DATE STARTED: 11/8/2023</td>
</tr>
<tr>
<td></td>
<td>DATE FINISHED: 11/8/2023</td>
</tr>
</tbody>
</table>

**METHOD OF INSTALLATION AND PURGING:**
Langan advanced a Bosch Rotary Hammer Drill to about three inches beneath the concrete slab. The sub-slab vapor point consisted of a 1/4-inch teflon-lined polyethylene tubing that was inserted at a depth of two inches below the bottom of the concrete slab. Langan field screened the sample location with a MultiRAE prior to sampling. The sample consisted of a 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation. Prior to sampling, the tubing was connected to the vapor point and sealed with bentonite to grade. The vapor point was purged using a MultiRAE. Before and after sampling the seal integrity at each sampling point was confirmed using helium tracer gas.

**TUBING TYPE/DIAMETER:** 3/16-inch ID, 1/4-inch OD Teflon-Lined Polyethylene Tubing

**TYPE OF MATERIAL ABOVE SEAL:** N/A

**IMPLANT SCREEN TYPE/LENGTH/DIAMETER:** None

**SEAL MATERIAL (Bentonite, Beeswax, Modeling Clay, etc.):** Bentonite

**BOREHOLE DIAMETER:** 1/2-inch

**FILTER PACK MATERIAL (Sand or Glass Beads):** None

**PURGE VOLUME (L):** N/A

**PURGE FLOW RATE (ML/MIN):** N/A

**PID AFTER PURGE (PPM):** 0

**HELIUM TEST IN TUBE (PPM):**
- Pre-sampling 17.2%
- Post-sampling 15.4%

**HELIUM TEST IN BUCKET (%):**
- Pre-sampling 0.0%
- Post-sampling 0.0%

**SAMPLE START TIME:** 8:17

**SAMPLE STOP TIME:** 16:32

**TOTAL SAMPLE TIME (MIN):** 495

**REGULATOR FLOW RATE (L/MIN):** 0.0045

**VOLUME OF SAMPLE (LITERS):** 2.2725

**PID AFTER SAMPLE (PPM):** 0

**SAMPLE MOISTURE CONTENT:** N/A

**CAN SERIAL NUMBER:** 2575

**REGULATOR SERIAL NUMBER:** 1121

**CAN START VACUUM PRESS. (" HG):** -30.02

**CAN STOP VACUUM PRESS. (" HG):** -6.46

**NOTES**
See Sample Location Plan

---

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
METHOD OF INSTALLATION AND SAMPLING:
Langan field screened the sample location with a MultiRAE photoionization detector prior to sampling. The sample consisted of 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate the 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation.

SAMPLE DETAILS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>VALUE</th>
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<tbody>
<tr>
<td>HEIGHT ABOVE GROUND (FT)</td>
<td>3</td>
</tr>
<tr>
<td>PID BEFORE SAMPLE (PPM)</td>
<td>0.0</td>
</tr>
<tr>
<td>SAMPLE START TIME</td>
<td>9:53</td>
</tr>
<tr>
<td>SAMPLE STOP TIME</td>
<td>16:56</td>
</tr>
<tr>
<td>TOTAL SAMPLE TIME (MIN)</td>
<td>423</td>
</tr>
<tr>
<td>REGULATOR FLOW RATE (L/MIN)</td>
<td>0.0045</td>
</tr>
<tr>
<td>VOLUME OF SAMPLE (LITERS)</td>
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<tr>
<td>PID AFTER SAMPLE (PPM)</td>
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</tr>
<tr>
<td>SAMPLE MOISTURE CONTENT</td>
<td>N/A</td>
</tr>
<tr>
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<td>REGULATOR SERIAL NUMBER</td>
<td>2002</td>
</tr>
<tr>
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</tr>
<tr>
<td>CAN STOP VACUUM PRESS. (&quot; HG)</td>
<td>-5.99</td>
</tr>
</tbody>
</table>
Langan field screened the sample location with a MultiRAE photoionization detector prior to sampling. The sample consisted of 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate the 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation.

**AIR SAMPLING LOG SHEET**

**Sample Number:** SVI_IA02_110823

<table>
<thead>
<tr>
<th>SAMPLE DETAILS</th>
<th>SAMPLE LOCATION SKETCH</th>
</tr>
</thead>
<tbody>
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<td><strong>HEIGHT ABOVE GROUND (FT):</strong></td>
<td>3</td>
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<tr>
<td><strong>PID BEFORE SAMPLE (PPM):</strong></td>
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<tr>
<td><strong>SAMPLE START TIME:</strong></td>
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<tr>
<td><strong>TOTAL SAMPLE TIME (MIN):</strong></td>
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<tr>
<td><strong>REGULATOR FLOW RATE (L/MIN):</strong></td>
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<tr>
<td><strong>VOLUME OF SAMPLE (LITERS):</strong></td>
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<tr>
<td><strong>SAMPLE MOISTURE CONTENT:</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>CAN SERIAL NUMBER:</strong></td>
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<tr>
<td><strong>REGULATOR SERIAL NUMBER:</strong></td>
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<tr>
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<tr>
<td><em><em>CAN STOP VACUUM PRESS. (</em> HG):</em>*</td>
<td>-3.52</td>
</tr>
</tbody>
</table>

**NOTES**

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.

21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
Langan field screened the sample location with a MultiRAE photoionization detector prior to sampling. The sample consisted of 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate the 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation.

### Sample Details

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Height Above Ground (FT)</td>
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</tr>
<tr>
<td>PID Before Sample (PPM)</td>
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<tr>
<td>Sample Start Time</td>
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<tr>
<td>Sample Stop Time</td>
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<tr>
<td>Total Sample Time (MIN)</td>
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<tr>
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</tr>
<tr>
<td>Regulator Serial Number</td>
<td>816</td>
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<tr>
<td>CAN Start Vacuum Press. (&quot; HG)</td>
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<tr>
<td>CAN Stop Vacuum Press. (&quot; HG)</td>
<td>-5.59</td>
</tr>
</tbody>
</table>

### Sample Location Sketch

- See Sample Location Plan

### Method of Installation and Sampling

- See Chemical Product Inventory in Appendix B

### Weather Conditions

- Temp: 40 - 59 Degrees Fahrenheit
- Wind: SE 4 mph
- Precipitation: None
- Pressure: 30.35 inHg

### Project Information

- Project: 2560-2580 Boston Road
- Project No.: 170684201
- Location: Bronx, NY
- Surface Elevation and Datum: N/A

---

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### Sample Details

<table>
<thead>
<tr>
<th>Height Above Ground (ft)</th>
<th>PID Before Sample (PPM)</th>
<th>Sample Start Time</th>
<th>Sample Stop Time</th>
<th>Total Sample Time (min)</th>
<th>Regulator Flow Rate (L/min)</th>
<th>Volume of Sample (Liters)</th>
<th>PID After Sample (PPM)</th>
<th>Sample Moisture Content</th>
<th>CAN Serial Number</th>
<th>Regulator Serial Number</th>
<th>Can Start Vacuum Press. (&quot; HG)</th>
<th>Can Stop Vacuum Press. (&quot; HG)</th>
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<tbody>
<tr>
<td>3</td>
<td>0.0</td>
<td>8:16</td>
<td>15:49</td>
<td>453</td>
<td>0.045</td>
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<td>416</td>
<td>124</td>
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<td>-5.66</td>
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### Notes

See Sample Location Plan

---

Langan Engineering, Environmental, Surveying, Landscape Architecture, and Geology D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
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**Sample Number:** SVI_IA06_110823

<table>
<thead>
<tr>
<th>PROJECT NO.</th>
<th>170684201</th>
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<tbody>
<tr>
<td>LOCATION</td>
<td>Bronx, NY</td>
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<tr>
<td>SURFACE ELEVATION AND DATUM</td>
<td>N/A</td>
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<tr>
<td>SAMPLE DATE STARTED</td>
<td>11/8/2023</td>
</tr>
<tr>
<td>DATE FINISHED</td>
<td>11/8/2023</td>
</tr>
<tr>
<td>SAMPLER</td>
<td>Brian Kenneally</td>
</tr>
<tr>
<td>INSPECTOR</td>
<td>Brian Kenneally</td>
</tr>
<tr>
<td>TYPE OF SAMPLING DEVICE</td>
<td>2.7-Liter Summa Canister</td>
</tr>
<tr>
<td>POTENTIAL SAMPLE INTERFERENCES</td>
<td>See Chemical Product Inventory in Appendix B</td>
</tr>
<tr>
<td>WEATHER CONDITIONS (PRECIP., TEMP., PRESS., WIND SPEED AND DIR.)</td>
<td>Temp: 42 - 52 Degrees Fahrenheit</td>
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<tr>
<td>Wind: N 6 mph</td>
<td></td>
</tr>
<tr>
<td>Precipitation: None</td>
<td></td>
</tr>
<tr>
<td>Pressure: 30.35 inHg</td>
<td></td>
</tr>
</tbody>
</table>

**METHOD OF INSTALLATION AND SAMPLING:**
Langan field screened the sample location with a MultiRAE photoionization detector prior to sampling. The sample consisted of 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate the 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation.

<table>
<thead>
<tr>
<th>SAMPLE DETAILS</th>
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<tr>
<td>HEIGHT ABOVE GROUND (FT):</td>
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<tr>
<td>PID BEFORE SAMPLE (PPM):</td>
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<tr>
<td>SAMPLE START TIME:</td>
<td>8.57</td>
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<td>SAMPLE STOP TIME:</td>
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<td>TOTAL SAMPLE TIME (MIN):</td>
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<tr>
<td>REGULATOR FLOW RATE (L/MIN):</td>
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<tr>
<td>VOLUME OF SAMPLE (LITERS):</td>
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<td>PID AFTER SAMPLE (PPM):</td>
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<tr>
<td>CAN STOP VACUUM PRESS. (&quot; HG):</td>
<td>-6.17</td>
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</tbody>
</table>

**NOTES**

---

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21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
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### SAMPLE DETAILS

<table>
<thead>
<tr>
<th>Height Above Ground (FT):</th>
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<tr>
<td>Can Stop Vacuum Press. (&quot; HG):</td>
<td>-4.97</td>
</tr>
</tbody>
</table>

### NOTES

See Sample Location Plan

---

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21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001-2727
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<table>
<thead>
<tr>
<th>SAMPLE DETAILS</th>
<th>SAMPLE LOCATION SKETCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEIGHT ABOVE GROUND (FT):</td>
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<td>-6.77</td>
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NOTES
**Sample Details**

<table>
<thead>
<tr>
<th>Height Above Ground (FT):</th>
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<td>PID Before Sample (PPM):</td>
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<tr>
<td>Can Stop Vacuum Press. (&quot;HG):</td>
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</tbody>
</table>

**Potential Sample Interferences:**

Vehicle emissions from active parking lot

**Weather Conditions (Precip., Temp., Press., Wind Speed and Dir.):**

- Temp: 42 - 52 Degrees Fahrenheit
- Wind: N 6 mph
- Precipitation: None
- Pressure: 30.35 inHg

**Method of Installation and Sampling:**

Langan field screened the sample location with a MultiRAE photoionization detector prior to sampling. The sample consisted of 2.7-L Summa canister fitted with an 8-hr flow control valve. The flow controller was zeroed and valve opened to initiate the 8-hr sample collection. The sample and flow controller were checked periodically during sampling to ensure proper operation.

**Sample Location Sketch**

See Sample Location Plan

**Notes**

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APPENDIX D

LABORATORY ANALYTICAL REPORT
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client ID</th>
<th>Matrix</th>
<th>Sample Location</th>
<th>Collection Date/Time</th>
<th>Receive Date</th>
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<tbody>
<tr>
<td>L2366599-01</td>
<td>SVI_SSV01_110823</td>
<td>SOIL_VAPOR</td>
<td>BRONX, NY</td>
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<tr>
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<td>11/08/23 16:44</td>
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</tr>
</tbody>
</table>
Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha’s policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.
Case Narrative (continued)

Report Revision

April 17, 2024 the report has been amended to report data for Naphthalene at the request of the client.

Report Revision

November 21, 2023 the report has been amended to report TICs at the request of the client.

Volatile Organics in Air
Canisters were released from the laboratory on November 1, 2023. The canister certification results are provided as an addendum.

Sample Receipt
The samples were logged in based on the Sample IDs listed on the canister tags and CoC. In all but two instances the canister ID numbers listed on the CoC did not match what was on the canister and canister tag with the sample ID.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  

Title: Technical Director/Representative  

Date: 04/17/24
AIR
**Sample Results**

<table>
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<tr>
<th>Parameter</th>
<th>ppbV Results</th>
<th>RL</th>
<th>MDL</th>
<th>ug/m³ Results</th>
<th>RL</th>
<th>MDL</th>
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<th>Dilution Factor</th>
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**Lab Number:** L2366599  
**Report Date:** 04/17/24  
**Sample Location:** BRONX, NY  
**Analytical Date:** 11/10/23 23:53  
**Analyst:** RAY  
**Matrix:** Soil_Vapor  
**Sample Depth:**  
**Analytical Method:** 48, TO-15  
**Sample ID:** SVI_SSV01_110823  
**Lab ID:** L2366599-01  
**Date Collected:** 11/08/23 16:57  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified  
**Report Number:** 170684201
**SAMPLE RESULTS**

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### SAMPLE RESULTS

**Lab ID:** L2366599-01  
**Client ID:** SVI_SSV01_110823  
**Sample Location:** BRONX, NY

**Sample Depth:**

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**Tentatively Identified Compounds**

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</table>
**SAMPLE RESULTS**

Lab ID: L2366599-01  
Client ID: SVI_SSV01_110823  
Sample Location: BRONX, NY  
Date Collected: 11/08/23 16:57  
Date Received: 11/08/23  
Field Prep: Not Specified  

Sample Depth:

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<tr>
<th>Parameter</th>
<th>ppbV Results</th>
<th>Qualifier</th>
<th>ug/m3 Results</th>
<th>Qualifier</th>
<th>Dilution Factor</th>
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<tbody>
<tr>
<td><strong>Volatile Organics in Air - Mansfield Lab</strong></td>
<td></td>
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Tentatively Identified Compounds:

<table>
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<tr>
<th>Compound</th>
<th>ppbV</th>
<th>Qualifier</th>
<th>Units</th>
<th>RDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decane (C10)</td>
<td>2.3</td>
<td>NJ</td>
<td>ppbV</td>
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<tr>
<td>Pentane</td>
<td>5.6</td>
<td>NJ</td>
<td>ppbV</td>
<td>1</td>
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<tr>
<td>Unknown</td>
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<td>J</td>
<td>ppbV</td>
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<td>Cyclotrisiloxane, Hexamethyl-</td>
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<td>ppbV</td>
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<td>J</td>
<td>ppbV</td>
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<tr>
<td>Butane</td>
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<td>Pentane, 2,4-dimethyl-</td>
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<td>ppbV</td>
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**Internal Standard**

<table>
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<th>% Recovery</th>
<th>Qualifier</th>
<th>Acceptance Criteria</th>
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<tr>
<td>1,4-Difluorobenzene</td>
<td>101</td>
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<td>Bromochloromethane</td>
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<tr>
<td>chlorobenzene-d5</td>
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<td>60-140</td>
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**Volatile Organics in Air - Mansfield Lab**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ppbV</th>
<th>ug/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dichlorodifluoromethane</strong></td>
<td>2.73</td>
<td>13.5</td>
</tr>
<tr>
<td><strong>Chloromethane</strong></td>
<td>0.221</td>
<td>0.456</td>
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<tr>
<td><strong>Freon-114</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Vinyl chloride</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>1,3-Butadiene</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Bromomethane</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Chloroethane</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Ethanol</strong></td>
<td>13.7</td>
<td>25.8</td>
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<td><strong>Vinyl bromide</strong></td>
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<td>ND</td>
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<td><strong>Acetone</strong></td>
<td>44.7</td>
<td>106</td>
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<td><strong>Isopropanol</strong></td>
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<td><strong>Tertiary butyl Alcohol</strong></td>
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<tr>
<td><strong>Methylene chloride</strong></td>
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<td><strong>3-Chloropropene</strong></td>
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<td><strong>Carbon disulfide</strong></td>
<td>1.94</td>
<td>6.04</td>
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<tr>
<td><strong>Freon-113</strong></td>
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<td>ND</td>
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<tr>
<td><strong>trans-1,2-Dichloroethene</strong></td>
<td>ND</td>
<td>ND</td>
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<tr>
<td><strong>1,1-Dichloroethane</strong></td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Methyl tert butyl ether</strong></td>
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<td>ND</td>
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<tr>
<td><strong>2-Butanone</strong></td>
<td>1.40</td>
<td>4.13</td>
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<tr>
<td><strong>cis-1,2-Dichloroethene</strong></td>
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**Dilution Factor**

<table>
<thead>
<tr>
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<tr>
<td>1</td>
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<tr>
<td>Parameter</td>
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<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Ethyl Acetate</td>
</tr>
<tr>
<td>Chloroform</td>
</tr>
<tr>
<td>Tetrahydrofuran</td>
</tr>
<tr>
<td>1,2-Dichloroethane</td>
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<tr>
<td>n-Hexane</td>
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<tr>
<td>1,1,1-Trichloroethane</td>
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<tr>
<td>Benzene</td>
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<tr>
<td>Carbon tetrachloride</td>
</tr>
<tr>
<td>Cyclohexane</td>
</tr>
<tr>
<td>1,2-Dichloropropane</td>
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<td>Bromodichloromethane</td>
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<tr>
<td>1,4-Dioxane</td>
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<tr>
<td>Trichloroethene</td>
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<tr>
<td>2,2,4-Trimethylpentane</td>
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<td>Heptane</td>
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<td>cis-1,3-Dichloropropene</td>
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<tr>
<td>4-Methyl-2-pentanone</td>
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<tr>
<td>trans-1,3-Dichloropropene</td>
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<tr>
<td>1,1,2-Trichloroethane</td>
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<tr>
<td>Toluene</td>
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<tr>
<td>Tetrachloroethene</td>
</tr>
<tr>
<td>Chlorobenzene</td>
</tr>
<tr>
<td>Ethylbenzene</td>
</tr>
</tbody>
</table>

The table above shows the sample results for various volatile organic compounds. Each compound is listed with its concentration in ppbV and ug/m³, along with the dilution factor. The results are below the method detection limit (MDL) and are marked as ND (Not Detected). The dilution factor is indicated for each entry.
### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201

| Lab ID: | L2366599-02 | Date Collected: | 11/08/23 15:42 |
| Client ID: | SVI_SSV04_110823 | Date Received: | 11/08/23 |
| Sample Location: | BRONX, NY | Field Prep: | Not Specified |

**Lab Number:** L2366599  
**Report Date:** 04/17/24

#### Sample Depth:

**Volatile Organics in Air - Mansfield Lab**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ppbV</th>
<th>ug/m3</th>
</tr>
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<tbody>
<tr>
<td>p/m-Xylene</td>
<td>0.738</td>
<td>3.21</td>
</tr>
<tr>
<td>Bromoform</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Styrene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,1,2,2-Tetrachloroethane</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>o-Xylene</td>
<td>0.307</td>
<td>1.33</td>
</tr>
<tr>
<td>4-Ethyltoluene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>0.205</td>
<td>1.01</td>
</tr>
<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>0.529</td>
<td>2.60</td>
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<tr>
<td>Benzyl chloride</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,3-Dichlorobenzene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,4-Dichlorobenzene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>1,2,4-Trichlorobenzene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
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<table>
<thead>
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<th>Parameter</th>
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<td>0.400</td>
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<td>0.200</td>
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<tr>
<td>Styrene</td>
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<td>0.200</td>
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<tr>
<td>1,1,2,2-Tetrachloroethane</td>
<td>ND</td>
<td>0.200</td>
</tr>
<tr>
<td>o-Xylene</td>
<td>0.307</td>
<td>0.200</td>
</tr>
<tr>
<td>4-Ethyltoluene</td>
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</tr>
<tr>
<td>1,3,5-Trimethylbenzene</td>
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<tr>
<td>1,2,4-Trimethylbenzene</td>
<td>0.529</td>
<td>0.200</td>
</tr>
<tr>
<td>Benzyl chloride</td>
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<td>0.200</td>
</tr>
<tr>
<td>1,3-Dichlorobenzene</td>
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<td>0.200</td>
</tr>
<tr>
<td>1,4-Dichlorobenzene</td>
<td>ND</td>
<td>0.200</td>
</tr>
<tr>
<td>1,2-Dichlorobenzene</td>
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<td>0.200</td>
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<tr>
<td>1,2,4-Trichlorobenzene</td>
<td>ND</td>
<td>0.200</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>ND</td>
<td>0.200</td>
</tr>
<tr>
<td>Hexachlorobutadiene</td>
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#### Tentatively Identified Compounds

<table>
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<tr>
<th>Parameter</th>
<th>Results</th>
<th>Qualifier</th>
<th>Units</th>
<th>RDL</th>
<th>Dilution Factor</th>
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<tbody>
<tr>
<td>Pentanal</td>
<td>1.5</td>
<td>NJ</td>
<td>ppbV</td>
<td>1</td>
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<tr>
<td>Cyclo-trisiloxane, Hexamethyl-unknown siloxane</td>
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<td>NJ</td>
<td>ppbV</td>
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<td>4.6</td>
<td>NJ</td>
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<tr>
<td>D-Limonene</td>
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</table>
### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-02  
**Client ID:** SVI_SSV04_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 15:42  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Sample Depth:**

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<th>Dilution Factor</th>
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<tbody>
<tr>
<td>Butane</td>
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<td>ppbV</td>
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<td>Isobutane</td>
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<td>ppbV</td>
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<td>Methyl Alcohol</td>
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<td>ppbV</td>
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<td>J</td>
<td>ppbV</td>
<td>1</td>
</tr>
<tr>
<td>Decane (C10)</td>
<td>2.3</td>
<td>NJ</td>
<td>ppbV</td>
<td>1</td>
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**Tentatively Identified Compounds**

<table>
<thead>
<tr>
<th>Internal Standard</th>
<th>% Recovery</th>
<th>Qualifier</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Difluorobenzene</td>
<td>103</td>
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<td>60-140</td>
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<tr>
<td>Bromochloromethane</td>
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<td>chlorobenzene-d5</td>
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## SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24  
**Date Collected:** 11/08/23 15:54  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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<th>RL</th>
<th>MDL</th>
<th>Qualifier</th>
<th>Dilution Factor</th>
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<tbody>
<tr>
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<td>ND</td>
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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-03  
**Client ID:** SVI_SSV05_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 15:54  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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**Results:**

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### SAMPLE RESULTS

**Volatile Organics in Air - Mansfield Lab**

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**Tentatively Identified Compounds**

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**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  

**Lab Number:** L2366599  
**Report Date:** 04/17/24  

**SAMPLE RESULTS**

Lab ID: L2366599-03  
Client ID: SVI_SSV05_110823  
Sample Location: BRONX, NY  
Date Collected: 11/08/23 15:54  
Date Received: 11/08/23  
Field Prep: Not Specified

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Tentatively Identified Compounds

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### Volatile Organics in Air - Mansfield Lab

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201

**Lab ID:** L2366599-04  
**Client ID:** SVI_SSV06_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 16:06  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

#### Volatile Organics in Air - Mansfield Lab

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### Volatile Organics in Air - Mansfield Lab

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# SAMPLE RESULTS

Lab ID: L2366599-04  
Client ID: SVI_SSV06_110823  
Sample Location: BRONX, NY  
Lab Number: L2366599  
Report Date: 04/17/24  
Date Collected: 11/08/23 16:06  
Date Received: 11/08/23  
Field Prep: Not Specified  
Report Date: 04/17/24  

## SAMPLE RESULTS

### Volatile Organics in Air - Mansfield Lab

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201

**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-05  
**Client ID:** SVI_SSV07_110823  
**Sample Location:** BRONX, NY

**Sample Depth:** Soil_Vapor  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/11/23 02:31  
**Analyst:** RAY

**Matrix:** Soil_Vapor  
**Sample Depth:** Soil_Vapor  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/11/23 02:31  
**Analyst:** RAY

**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 16:00  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

#### Volatile Organics in Air - Mansfield Lab

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### Tentatively Identified Compounds

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## SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24  
**Lab ID:** L2366599-05  
**Client ID:** SVI_SSV07_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified  

### Sample Depth:

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### Tentatively Identified Compounds

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### Internal Standard

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**SAMPLE RESULTS**

**Lab ID:** L2366599-06  
**Client ID:** SVI_SSV08_110823  
**Sample Location:** BRONX, NY

**Sample Depth:** Soil_Vapor  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/11/23 03:10  
**Analyst:** RAY

### Volatile Organics in Air - Mansfield Lab

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**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-06  
**Client ID:** SVI_SSV08_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 16:20  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**SVI_SSV08_110823 Client ID:**  
**Date Collected:** 11/08/23  
**Date Received:** 11/08/23  
**Client ID:** SVI_SSV08_110823  
**Sample Location:** BRONX, NY

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SAMPLE RESULTS

Lab ID: L2366599-06
Client ID: SVI_SSV08_110823
Sample Location: BRONX, NY

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Tentatively Identified Compounds

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SAMPLE RESULTS

Lab ID: L2366599-06
Client ID: SVI_SSV08_110823
Sample Location: BRONX, NY

Sample Depth: 2560-2580 BOSTON ROAD 170684201

Date Collected: 11/08/23 16:20
Date Received: 11/08/23
Field Prep: Not Specified

Volatile Organics in Air - Mansfield Lab

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Internal Standard

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### Tentatively Identified Compounds

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Sample Depth:...
### Project Name: 2560-2580 BOSTON ROAD  
### Project Number: 170684201

**SAMPLE RESULTS**

Lab ID: L2366599-07  
Client ID: SVI_SSV09_110823  
Sample Location: BRONX, NY

Sample Depth:

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Lab ID: L2366599-08  
Client ID: SVI_IA01_110823  
Sample Location: BRONX, NY

Sample Depth:  
Matrix: Air  
Analytical Method: 48, TO-15  
Analytical Date: 11/10/23 18:37  
Analyst: RAY

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Client ID: SVI_IA01_110823  
Date Collected: 11/08/23 16:56

**Note:** Dilution Factor = Qualifier / MDL
### Sample Results

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-08  
**Client ID:** SVI_IA01_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 16:56  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-08  
**Client ID:** SVI_IA01_110823  
**Sample Location:** BRONX, NY

**Sample Depth:**

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**Tentatively Identified Compounds**

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**SAMPLE RESULTS**

**Volatile Organics in Air - Mansfield Lab**

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**Internal Standard % Recovery**

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### SAMPLE RESULTS

Lab ID: L2366599-08  
Client ID: SVI_IA01_110823  
Sample Location: BRONX, NY  
Date Collected: 11/08/23 16:56  
Date Received: 11/08/23  
Field Prep: Not Specified

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### Internal Standard

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Project Name: 2560-2580 BOSTON ROAD  
Project Number: 170684201  
Lab Number: L2366599  
Report Date: 04/17/24  
Matrix: Air  
Analytical Method: 48, TO-15-SIM  
Analytical Date: 11/10/23 18:37  
Analyst: RAY
### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-09  
**Client ID:** SVI_IA04_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 15:49  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48, TO-15  
**Analytical Date:** 11/10/23 19:16  
**Analyst:** RAY

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Client ID: SVI_IA04_110823  
Sample Location: BRONX, NY  
Date Collected: 11/08/23 15:49  
Date Received: 11/08/23  
Field Prep: Not Specified

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**SAMPLE RESULTS**

Lab ID: L2366599-09  
Client ID: SVI_IA04_110823  
Sample Location: BRONX, NY  

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### Sample Results

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

#### Volatile Organics in Air by SIM - Mansfield Lab

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**Matrix:** Air

**Analytical Method:** 48, TO-15-SIM

**Analytical Date:** 11/10/23 19:16

**Analyst:** RAY

**Date Collected:** 11/08/23 15:49

**Date Received:** 11/08/23

**Field Prep:** Not Specified
### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Client ID:** SVI_IA05_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 15:55  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Matrix:** Air  
**Analytical Method:** 48, TO-15  
**Analytical Date:** 11/10/23 19:56  
**Analyst:** RAY

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**Lab ID:** L2366599-10  
**Client ID:** SVI_IA05_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 15:55  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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**Tentatively Identified Compounds**

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SAMPLE RESULTS

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### Sample Results

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

#### Sample Details
- **Lab ID:** L2366599-11  
- **Client ID:** SVI_IA06_110823  
- **Sample Location:** BRONX, NY  
- **Matrix:** Air  
- **Analytical Method:** 48, TO-15  
- **Analytical Date:** 11/10/23 20:35  
- **Analyst:** RAY

#### Volatile Organics in Air - Mansfield Lab

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Tentatively Identified Compounds

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**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**SAMPLE RESULTS**

Lab ID: L2366599-11  
Client ID: SVI_IA06_110823  
Sample Location: BRONX, NY  
Date Collected: 11/08/23 16:10  
Date Received: 11/08/23  
Field Prep: Not Specified

**Sample Depth:**

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**Tentatively Identified Compounds**

| Methyl Alcohol | 14 | NJ | ppbV | 1 |

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-11  
**Client ID:** SVI_IA06_110823  
**Sample Location:** BRONX, NY

**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48, TO-15-SIM  
**Analytical Date:** 11/10/23 20:35  
**Analyst:** RAY

**Date Collected:** 11/08/23 16:10  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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**Internal Standard % Recovery Qualifier Acceptance Criteria**

- 1,4-difluorobenzene: 101, R, 60-140
- Bromochloromethane: 103, R, 60-140
- Chlorobenzene-d5: 98, R, 60-140
## SAMPLE RESULTS

**Lab ID:** L2366599-12  
**Client ID:** SVI_IA07_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 16:01  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified  
**Report Date:** 04/17/24

### Sample Depth:
Matrix: Air  
Analytical Method: 48,TO-15  
Analytical Date: 11/10/23 21:15  
Analyst: RAY

### Volatile Organics in Air - Mansfield Lab

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### Sample Results

#### Volatile Organics in Air - Mansfield Lab

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**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-12  
**Client ID:** SVI_IA07_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 16:01  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Sample Depth:**

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### Lab ID: L2366599-12
### Client ID: SVI_IA07_110823
### Sample Location: BRONX, NY
### Date Collected: 11/08/23 16:01
### Date Received: 11/08/23
### Field Prep: Not Specified

## SAMPLE RESULTS

### Sample Depth:

#### Volatile Organics in Air - Mansfield Lab

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### Tentatively Identified Compounds

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### Sample Results

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201

**Lab Number:** L2366599  
**Report Date:** 04/17/24

#### Volatile Organics in Air by SIM - Mansfield Lab

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#### Internal Standard

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-13  
**Client ID:** SVI_IA08_110823  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/08/23 16:13  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Sample Depth:**  
**Matrix:** Air  
**Anaytical Method:** 48,TO-15  
**Analytical Date:** 11/10/23 21:54  
**Analyst:** RAY

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**Table Notes:**  
- MDL: Method Detection Limit  
- RL: Report Limit  
- Qualifier: RL

**Sample Depth:**  
**Matrix:** Air  
**Anaytical Method:** 48,TO-15  
**Analytical Date:** 11/10/23 21:54  
**Analyst:** RAY
### SAMPLE RESULTS

**Volatile Organics in Air - Mansfield Lab**

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### SAMPLE RESULTS

Lab ID: L2366599-13  
Client ID: SVI_IA08_110823  
Sample Location: BRONX, NY

**Sample Depth:**

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<th>RL</th>
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**Tentatively Identified Compounds**

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Lab ID: L2366599-13
Client ID: SVI_IA08_110823
Sample Location: BRONX, NY

Date Collected: 11/08/23 16:13
Date Received: 11/08/23
Field Prep: Not Specified

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## Volatile Organics in Air by SIM - Mansfield Lab

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**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-14  
**Client ID:** SVI_IA09_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 16:44  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

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### Tentatively Identified Compounds

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<td>Butane</td>
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### Volatile Organics in Air - Mansfield Lab

#### Tentatively Identified Compounds

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#### Internal Standard

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**Internal Standard**

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**Sample Details**

- **Project Name:** 2560-2580 BOSTON ROAD
- **Project Number:** 170684201
- **Lab Number:** L2366599
- **Report Date:** 04/17/24
- **Lab ID:** L2366599-14
- **Client ID:** SVI_IA09_110823
- **Sample Location:** BRONX, NY
- **Date Collected:** 11/08/23 16:44
- **Date Received:** 11/08/23
- **Field Prep:** Not Specified

**Table Notes:**

- ND: Not Detected
- MDL: Method Detection Limit
- RL: Reporting Level
- acceptance criteria: 60-140
### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Lab ID:** L2366599-15  
**Client ID:** SVI_AA01_110823  
**Sample Location:** BRONX, NY

**Date Collected:** 11/08/23 15:21  
**Date Received:** 11/08/23  
**Field Prep:** Not Specified

**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/10/23 17:57  
**Analyst:** RAY

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**Qualifiers:**

- ND: Not Detected
- RL: Read Limit
- MDL: Method Detection Limit

**Dilution Factor:**

- 1

**Sample Depth:**

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SAMPLE RESULTS

Lab ID: L2366599-15
Client ID: SVI_AA01_110823
Sample Location: BRONX, NY

Sample Depth:

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<tr>
<td>Hexachlorobutadiene</td>
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Tentatively Identified Compounds

| Silanol, Trimethyl-                | 1.6  | NJ    | ppbV  | 1   |
| Unknown                            | 1.2  | J     | ppbV  | 1   |
| unknown siloxane                   | 2.2  | J     | ppbV  | 1   |
| Cyclotrisiloxane, Hexamethyl-      | 7.3  | NJ    | ppbV  | 1   |
SAMPLE RESULTS

Lab ID: L2366599-15
Client ID: SVI_AA01_110823
Sample Location: BRONX, NY

Volatile Organics in Air - Mansfield Lab

<table>
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<tr>
<th>Parameter</th>
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<th>RL</th>
<th>MDL</th>
<th>ug/m3 Results</th>
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Tentatively Identified Compounds

<table>
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<th>% Recovery</th>
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<th>Acceptance Criteria</th>
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<td>60-140</td>
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<td>Bromochloromethane</td>
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<td>chlorobenzene-d5</td>
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**SAMPLE RESULTS**

Lab ID: L2366599-15  
Client ID: SVI_AA01_110823  
Sample Location: BRONX, NY

**Parameter** | **ppbV** Results | **RL** | **MDL** | **ug/m3** Results | **RL** | **MDL** | Qualifier | **Dilution Factor**
--- | --- | --- | --- | --- | --- | --- | --- | ---
Vinyl chloride | ND | 0.020 | -- | ND | 0.051 | -- | 1
1,1-Dichloroethene | ND | 0.020 | -- | ND | 0.079 | -- | 1
cis-1,2-Dichloroethene | ND | 0.020 | -- | ND | 0.079 | -- | 1
1,1,1-Trichloroethane | ND | 0.020 | -- | ND | 0.109 | -- | 1
Carbon tetrachloride | 0.058 | 0.020 | -- | 0.365 | 0.126 | -- | 1
Trichloroethene | ND | 0.020 | -- | ND | 0.107 | -- | 1
Tetrachloroethene | 0.067 | 0.020 | -- | 0.454 | 0.136 | -- | 1

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<th>Internal Standard</th>
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<th>Acceptance Criteria</th>
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**Batch Quality Control**

**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/10/23 16:38

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### Batch Quality Control

Analytical Method: 48, TO-15  
Analytical Date: 11/10/23 16:38

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Volatile Organics in Air - Mansfield Lab for sample(s): 01-15 Batch: WG1850973-4

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No Tentatively Identified Compounds
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**Batch Quality Control**

**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 11/10/23 17:17

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**Volatile Organics in Air by SIM - Mansfield Lab for sample(s): 08-15 Batch: WG1850974-4**
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### Lab Control Sample Analysis

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

**Volatile Organics in Air by SIM - Mansfield Lab**  
Associated sample(s): 08-15  
Batch: WG1850974-3

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### Lab Duplicate Analysis
#### Batch Quality Control

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

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| Volatile Organics in Air - Mansfield Lab  
Associated sample(s): 01-15  
QC Batch ID: WG1850973-5  
QC Sample: L2366599-13  
Client ID: SVI_IA08_110823 |
<p>| Dichlorodifluoromethane       | 0.556         | 0.550           | ppbV  | 1   |      | 25         |
| Chloromethane                 | 0.919         | 0.932           | ppbV  | 1   |      | 25         |
| Freon-114                     | ND            | ND              | ppbV  | NC  |      | 25         |
| Vinyl chloride                | ND            | ND              | ppbV  | NC  |      | 25         |
| 1,3-Butadiene                 | ND            | ND              | ppbV  | NC  |      | 25         |
| Bromomethane                  | ND            | ND              | ppbV  | NC  |      | 25         |
| Chloroethane                  | ND            | ND              | ppbV  | NC  |      | 25         |
| Ethanol                       | 168           | 154             | ppbV  | 9   |      | 25         |
| Vinyl bromide                 | ND            | ND              | ppbV  | NC  |      | 25         |
| Acetone                       | 12.4          | 12.3            | ppbV  | 1   |      | 25         |
| Trichlorofluoromethane        | 0.233         | 0.226           | ppbV  | 3   |      | 25         |
| Isopropanol                   | 5.61          | 5.51            | ppbV  | 2   |      | 25         |
| 1,1-Dichloroethene            | ND            | ND              | ppbV  | NC  |      | 25         |
| Tertiary butyl Alcohol        | ND            | ND              | ppbV  | NC  |      | 25         |
| Methylene chloride            | 0.656         | 0.640           | ppbV  | 2   |      | 25         |
| 3-Chloropropene               | ND            | ND              | ppbV  | NC  |      | 25         |
| Carbon disulfide              | ND            | ND              | ppbV  | NC  |      | 25         |
| Freon-113                     | ND            | ND              | ppbV  | NC  |      | 25         |
| trans-1,2-Dichloroethene      | ND            | ND              | ppbV  | NC  |      | 25         |
| 1,1-Dichloroethene            | ND            | ND              | ppbV  | NC  |      | 25         |
| Methyl tert butyl ether        | ND            | ND              | ppbV  | NC  |      | 25         |</p>
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### Lab Duplicate Analysis

#### Batch Quality Control

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366599  
**Report Date:** 04/17/24

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## Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 10/20/23 20:14  
**Analyst:** BJB

### Volatile Organics in Air - Mansfield Lab

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**Qualifiers:**
- RL: Result lower than the method detection limit (MDL)
- MDL: Method detection limit

**Dilution Factors:**
- 1

**Date Collected:** 10/19/23 16:00  
**Date Received:** 10/20/23  
**Field Prep:** Not Specified
## Tertiary butyl Alcohol

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## Air Canister Certification Results

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### Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**

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**Volatile Organics in Air - Mansfield Lab**

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## Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2362341  
**Report Date:** 04/17/24

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**

**Sample Depth:**

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**Volatile Organics in Air - Mansfield Lab**

### Tentatively Identified Compounds

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**No Tentatively Identified Compounds**
## Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 10/20/23 20:14  
**Analyst:** BJB

### Volatile Organics in Air by SIM - Mansfield Lab

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**Date Collected:** 10/19/23 16:00  
**Date Received:** 10/20/23  
**Field Prep:** Not Specified  
**Report Date:** 04/17/24
# Volatile Organics in Air by SIM - Mansfield Lab

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### Volatile Organics in Air by SIM - Mansfield Lab

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### Internal Standard

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**Lab ID:** L2362937-03  
**Client ID:** CAN 1724 SHELF 9  
**Date Collected:** 10/24/23 10:00  
**Date Received:** 10/24/23  
**Field Prep:** Not Specified

**Sample Location:** L2362937-03

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Air Canister Certification Results

Lab ID: L2362937-03
Client ID: CAN 1724 SHELF 9
Sample Location: 

Sample Depth:

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Tentatively Identified Compounds

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No Tentatively Identified Compounds
## Air Canister Certification Results

**Lab ID:** L2362937-03  
**Client ID:** CAN 1724 SHELF 9  
**Sample Location:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 10/24/23 22:11  
**Analyst:** BJB  

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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2362937  
**Report Date:** 04/17/24  
**Client ID:** CAN 1724 SHELF 9  
**Sample Location:**

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## Air Canister Certification Results

**Lab ID:** L2362937-03  
**Client ID:** CAN 1724 SHELF 9  
**Sample Location:**  

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### Air Canister Certification Results

**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:**  
**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 10/25/23 23:53  
**Analyst:** BJB  

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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:**  
**Date Collected:** 10/25/23 11:00  
**Date Received:** 10/25/23  
**Field Prep:** Not Specified

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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2363206  
**Report Date:** 04/17/24  
**Client ID:** CAN 403 SHELF 2  

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## Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2363206  
**Report Date:** 04/17/24

**Sample Location:**

### Volatile Organics in Air - Mansfield Lab

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### Tentatively Identified Compounds

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No Tentatively Identified Compounds

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Sample Location: 

- Lab ID: L2363206-06
- Client ID: CAN 403 SHELF 2
- Sample Location: 

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Project Name: BATCH CANISTER CERTIFICATION
Project Number: CANISTER QC BAT
Lab Number: L2363206
Report Date: 04/17/24

Date Collected: 10/25/23 11:00
Date Received: 10/25/23
Field Prep: Not Specified
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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2363206  
**Report Date:** 04/17/24  
**Date Collected:** 10/25/23 11:00  
**Date Received:** 10/25/23  
**Field Prep:** Not Specified  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:**

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<td>1,3-Dichlorobenzene</td>
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<td>0.020</td>
<td>-</td>
<td>ND</td>
<td>0.120</td>
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<tr>
<td>1,4-Dichlorobenzene</td>
<td>ND</td>
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<td>-</td>
<td>ND</td>
<td>0.120</td>
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### Air Canister Certification Results

**Lab ID:** L2363206-06  
**Date Collected:** 10/25/23 11:00  
**Client ID:** CAN 403 SHELF 2  
**Date Received:** 10/25/23  
**Sample Location:** L2363206-06  
**Field Prep:** Not Specified

#### Volatile Organics in Air by SIM - Mansfield Lab

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ppbV Results</th>
<th>RL</th>
<th>MDL</th>
<th>ug/m³ Results</th>
<th>RL</th>
<th>MDL</th>
<th>Qualifier</th>
<th>Dilution Factor</th>
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<tbody>
<tr>
<td>sec-Butylbenzene</td>
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<td>0.200</td>
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<td>p-Isopropyltoluene</td>
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<td>ND</td>
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<td>1,2-Dichlorobenzene</td>
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<td>ND</td>
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<tr>
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<tr>
<td>1,2,4-Trichlorobenzene</td>
<td>ND</td>
<td>0.050</td>
<td>--</td>
<td>ND</td>
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<tr>
<td>Naphthalene</td>
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<td>1,2,3-Trichlorobenzene</td>
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<td>--</td>
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#### Internal Standard % Recovery

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<th>Acceptance Criteria</th>
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<td>1,4-difluorobenzene</td>
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<tr>
<td>bromochloromethane</td>
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<tr>
<td>chlorobenzene-d5</td>
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**Sample Receipt and Container Information**

Were project specific reporting limits specified?

**YES**

### Cooler Information

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<tr>
<th>Cooler</th>
<th>Custody Seal</th>
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### Container Information

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<th>Final (pH)</th>
<th>Temp (\text{deg C})</th>
<th>Pres</th>
<th>Seal</th>
<th>Frozen Date/Time</th>
<th>Analysis(*)</th>
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<tr>
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<td>NA</td>
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<td>TO15-LL(30)</td>
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<td>TO15-LL(30)</td>
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<td>TO15-LL(30),TO15-SIM(30)</td>
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<td>TO15-LL(30),TO15-SIM(30)</td>
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</tr>
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</table>

*Values in parentheses indicate holding time in days*
GLOSSARY

Acronyms

DL  · Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL  · Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC  · Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA  · Environmental Protection Agency.

LCS  · Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD  · Laboratory Control Sample Duplicate: Refer to LCS.

LFB  · Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD  · Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ  · Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL  · Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS  · Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD  · Matrix Spike Sample Duplicate: Refer to MS.

NA  · Not Applicable.

NC  · Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA  · N-Nitrosodiphenylamine/Diphenylamine.

NI  · Not Ignitable.

NP  · Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR  · No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL  · Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD  · Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM  · Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP  · Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF  · Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ  · Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC  · Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report
Footnotes

1. The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference methods documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA, this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Organic samples in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benzo[a]anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno[1,2,3-cd]pyrene, Dibenzo(ah)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW Compliance analysis only, the 'PFAS, Total (6) result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A. Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.
B. The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MAP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MAP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MAP-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the concentration found in the blank. For NJ-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For NJ-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the concentration found in the blank. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the concentration found in the blank.
C. Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
D. Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
E. Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
F. The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.
G. The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.
H. The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
I. The lower value for the two columns has been reported due to obvious interference.
J. Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
M. Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
**Data Qualifiers**

**ND** - Not detected at the reporting limit (RL) for the sample.

**NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

**P** - The RPD between the results for the two columns exceeds the method-specified criteria.

**Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

**R** - Analytical results are from sample re-analysis.

**RE** - Analytical results are from sample re-extraction.

**S** - Analytical results are from modified screening analysis.

**V** - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

**Z** - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)
REFERENCES


LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at its own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.
The following analytes are not included in our Primary NELAP Scope of Accreditation:

**Westborough Facility**
- EPA 624.1: m/p-xylene, o-xylene, Naphthalene
- EPA 625.1: alpha-Terpineol
- EPA 8260D: NPW: m/p-xylene, o-xylene, Naphthalene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
- EPA 8270E: NPW: Dimethylnaphthalene, 1,4-Diphenyhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene, 1,4-Diphenyhydrazine.
- SM4500: NPW: Aminable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

**Mansfield Facility**
- SM 2540D: TSS.
- EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Benzothiophene, 1-Methylnaphthalene.
- Nonpotable Water: EPA RSK-175 Dissolved Gases
- Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

**Westborough Facility:**
- **Drinking Water**
  - EPA 524.2: THMs and VOCs; EPA 504.1: EDB, DBCP.
  - Microbiology: SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.
- **Non-Potable Water**
  - EPA 624.1: Volatile Halocarbons & Aromatics,
  - EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
  - EPA 625.1: SVOC (Acid/Base/Neutral Extractables),
  - Microbiology: SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.

**Mansfield Facility:**
- **Drinking Water**
  - EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg. EPA 522, EPA 537.1.
- **Non-Potable Water**
  - EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
  - EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
  - EPA 245.1 Hg.
  - SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.
**AIR ANALYSIS**

**CHAIN OF CUSTODY**

**ALPHA Analytical**
320 Forbes Blvd, Mansfield, MA 02048
TEL: 508-822-9300 FAX: 508-822-3288

**Client Information**

Client: **Langan**
Address: **360 W 31st Street**
Phone: **212 479 5400**

Email: **Lesmail@langan.com**
Fax:

**Project Information**

Project Name: 2560 Boston Road
Project Location: **Bronx, NY**
Project #: **170684201**
Project Manager: **Laneses Lesmail**

**ALPHA Quote #:**

**Turn-Around Time**

☐ Standard  ☐ RUSH (only confirmed if pre-approved)

Date Due:  
Time:

**Report Information - Data Deliverables**

☐ FAX  ☐ AE/Ex
Criteria Checker:
(Nota: based on Regulatory Criteria Indicated)
Other Formats:
☐ EMAIL (standard pdf report)
☐ Additional Deliverables:

Report ID: (if different than Project Manager)

**Regulatory Requirements/Report Limits**

**State/Fed**

Program
Res / Comm

**Analysis**

All Columns Below Must Be Filled Out

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<th>ALPHA Lab ID (Lab Use Only)</th>
<th>Sample ID</th>
<th>COLLECTION</th>
<th>Initial Vacuum</th>
<th>Final Vacuum</th>
<th>Sample Matrix</th>
<th>Sampler's Initials</th>
<th>I.D.</th>
<th>I.D. - Flow Controller</th>
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<td>BV</td>
<td>27L</td>
<td>276.13 T0-16</td>
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<tr>
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<td>SVI-SSVOL_110823</td>
<td>1/18/23 8:15</td>
<td>1542 -3026 -5.45</td>
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</tbody>
</table>

**Sample Matrix Codes**

AA = Ambient Air (Indoor/Outdoor)  
SV = Soil Vapor/Landfill Gas/SVE  
Other = Please Specify

**Container Type**

<table>
<thead>
<tr>
<th>Relinquished By</th>
<th>Date/Time</th>
<th>Received By</th>
<th>Date/Time</th>
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<tbody>
<tr>
<td>BKennedy</td>
<td>11/12/23</td>
<td>Anthony Green</td>
<td>11/4/23 0430</td>
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<td>Anthony Green</td>
<td>11/12/23</td>
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<td>11/14/23 0430</td>
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</table>

Please print clearly, legibly and completely. Samples can not be logged in and turnarounds time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.
**AIR ANALYSIS**

**CHAIN OF CUSTODY**

**Project Information**
- **Project Name:** 7560 Boston Road
- **Project Location:** Bronx, NY
- **Project #:** 170684201
- **Project Manager:** Lamees Eisma

**Turn-Around Time**
- **Standard**
- **RUSH** (only confirmed if pre-approved)

**Date Rec'd in Lab:** 11/9/23

**Report Information - Data Deliverables**
- **FAX**
- **ADEEx**

**Criteria Checker:** (Default based on Regulatory Criteria Indicated)

**Other Formats:**
- **EMAIL** (standard pdf report)
- **Additional Deliverables**: 

**Report to:** (if different than Project Manager)

**ALPHA Job #: L2346599**

---

**ANALYSIS**

**ALPHA Lab ID (Lab Use Only)**

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<th>COLLECTION</th>
<th>End Date</th>
<th>Start Time</th>
<th>End Time</th>
<th>Initial Vacuum</th>
<th>Final Vacuum</th>
<th>Sample Matrix</th>
<th>Sampler's Initials</th>
<th>Can Size</th>
<th>ID</th>
<th>Can</th>
<th>ID - Flow Controller</th>
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</thead>
</table>

**SAMPLE MATRIX CODES**
- AA = Ambient Air (Indoor/Outdoor)
- SV = Soil Vapor/Landfill Gas/SVE
- Other = Please Specify

**Sample Comments (i.e. PID)**

Please report any compounds that would be reported as tentatively identified compounds.

---

**Container Type**

**Reworked By:**

**Date/Time:**

**Received By:**

**Date/Time:**

---

Please print clearly, legibly and completely. Samples cannot be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.
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<thead>
<tr>
<th>Alpha Sample ID</th>
<th>Client ID</th>
<th>Matrix</th>
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<tr>
<td>L2366947-01</td>
<td>SVI_SSV02_110923</td>
<td>SOIL_VAPOR</td>
<td>BRONX, NY</td>
<td>11/09/23 16:40</td>
<td>11/09/23</td>
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<tr>
<td>L2366947-02</td>
<td>SVI_SSV03_110923</td>
<td>SOIL_VAPOR</td>
<td>BRONX, NY</td>
<td>11/09/23 16:09</td>
<td>11/09/23</td>
</tr>
<tr>
<td>L2366947-03</td>
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<td></td>
<td>11/09/23</td>
</tr>
</tbody>
</table>
Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha’s policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.
Case Narrative (continued)

Report Revision
April 7, 2024 the report has been amended to report data for Naphthalene at the request of the client.

Report Revision
November 21, 2023 the report has been amended to report TICs at the request of the client.

Volatile Organics in Air
Canisters were released from the laboratory on November 1, 2023. The canister certification results are provided as an addendum.

Sample Receipt
The samples were logged in based on the Sample IDs listed on the canister tags and CoC. In all but two instances the canister ID numbers listed on the CoC did not match what was on the canister and canister tag with the sample ID.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

Christopher J. Anderson

Title: Technical Director/Representative

Date: 04/17/24
AIR
## SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Lab ID:** L2366947-01  
**Client ID:** SVI_SSV02_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 16:40  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

**Matrix:** Soil_Vapor  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/15/23 00:42  
**Analyst:** RAY

### Volatile Organics in Air - Mansfield Lab

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Results</strong></td>
<td>RL</td>
<td>MDL</td>
</tr>
<tr>
<td>Dichlorodifluoromethane</td>
<td>0.369</td>
<td>0.200</td>
</tr>
<tr>
<td>Chloromethane</td>
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</tr>
<tr>
<td>Freon-114</td>
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<td>0.200</td>
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<tr>
<td>Vinyl chloride</td>
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<td>0.200</td>
</tr>
<tr>
<td>1,3-Butadiene</td>
<td>ND</td>
<td>0.200</td>
</tr>
<tr>
<td>Bromomethane</td>
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<td>0.200</td>
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<tr>
<td>Chloroethane</td>
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<td>Ethanol</td>
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<td>Acetone</td>
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<td>Trichlorofluoromethane</td>
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<td>Isopropanol</td>
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<td>3-Chloropropene</td>
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<td>1,1-Dichloroethane</td>
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<tr>
<td>cis-1,2-Dichloroethene</td>
<td>ND</td>
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</table>
### SAMPLE RESULTS

**Parameter** | **ppbV** | **ug/m3** | **Dilution Factor**
--- | --- | --- | ---
Ethyl Acetate | ND | ND | 1
Chloroform | 0.433 | 2.11 | 1
Tetrahydrofuran | ND | ND | 1
1,2-Dichloroethane | ND | ND | 1
n-Hexane | 8.68 | 30.6 | 1
1,1,1-Trichloroethane | ND | ND | 1
Benzene | 4.72 | 15.1 | 1
Carbon tetrachloride | ND | ND | 1
Cyclohexane | 1.89 | 6.51 | 1
1,2-Dichloropropane | ND | ND | 1
Bromodichloromethane | ND | ND | 1
1,4-Dioxane | ND | ND | 1
Trichloroethene | ND | ND | 1
2,2,4-Trimethylpentane | 3.14 | 14.7 | 1
Heptane | 5.53 | 22.7 | 1
cis,1,3-Dichloropropene | ND | ND | 1
4-Methyl-2-pentanone | ND | ND | 1
trans,1,3-Dichloropropene | ND | ND | 1
1,1,2-Trichloroethane | ND | ND | 1
Toluene | 21.2 | 79.9 | 1
2-Hexanone | ND | ND | 1
Dibromochloromethane | ND | ND | 1
1,2-Dibromoethane | ND | ND | 1
Tetrachloroethene | 0.324 | 2.20 | 1
Chlorobenzene | ND | ND | 1
Ethylbenzene | 2.89 | 12.6 | 1
**SAMPLE RESULTS**

**Lab ID:** L2366947-01  
**Client ID:** SVI_SSV02_110923  
**Sample Location:** BRONX, NY

**Sample Depth:**

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<tr>
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<th>MDL</th>
<th>ug/m3 Results</th>
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<th>MDL</th>
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<td>Bromoform</td>
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<td>1,1,2,2-Tetrachloroethane</td>
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<td>4-Ethyltoluene</td>
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<td>1,2,4-Trimethylbenzene</td>
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<td>Naphthalene</td>
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<td>Hexachlorobutadiene</td>
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**Tentatively Identified Compounds**

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<th>Results</th>
<th>Qualifier</th>
<th>Units</th>
<th>RDL</th>
<th>Dilution Factor</th>
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<td>NJ</td>
<td>ppbV</td>
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<td>Silanol, Trimethyl-</td>
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<td>D-Limonene</td>
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<td>Hexane, 2,5-dimethyl-</td>
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## SAMPLE RESULTS

**Lab ID:** L2366947-01  
**Client ID:** SVI_SSV02_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 16:40  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

### Sample Depth:

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<td>NJ</td>
</tr>
<tr>
<td>Pentane, 2,3,4-trimethyl-</td>
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<td>NJ</td>
</tr>
<tr>
<td>Pentane, 3-methyl-</td>
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<td>NJ</td>
</tr>
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<td>J</td>
</tr>
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<td>3-Carene</td>
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<tr>
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<td>J</td>
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<tr>
<td><strong>Internal Standard</strong></td>
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### Tentatively Identified Compounds

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Lab Number:** L2366947  
**Project Number:** 170684201  
**Report Date:** 04/17/24

**Lab ID:** L2366947-02  
**Client ID:** SVI_SSV03_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 16:09  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

**Matrix:** Soil_Vapor  
**Analytical Method:** 48, TO-15  
**Analytical Date:** 11/15/23 01:13  
**Analyst:** RAY

### Volatile Organics in Air - Mansfield Lab

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## SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Lab ID:** L2366947-02  
**Client ID:** SVI_SSV03_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 16:09  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

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**SAMPLE RESULTS**

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Lab ID:** L2366947-02  
**Client ID:** SVI_SSV03_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 16:09  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

**Sample Depth:**

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**Tentatively Identified Compounds**

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SAMPLE RESULTS

Lab ID: L2366947-02
Client ID: SVI_SSV03_110923
Sample Location: BRONX, NY

Date Collected: 11/09/23 16:09
Date Received: 11/09/23
Field Prep: Not Specified

Sample Depth:

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Tentatively Identified Compounds

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<td>chlorobenzene-d5</td>
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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Lab ID:** L2366947-03  
**Client ID:** SVI_IA02_110923  
**Sample Location:** BRONX, NY

**Matrix:** Air  
**Analytical Method:** 48, TO-15  
**Analytical Date:** 11/14/23 00:29  
**Analyst:** RAY

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**Results**

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201

**Lab ID:** L2366947-03  
**Client ID:** SVI_IA02_110923  
**Sample Location:** BRONX, NY  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Date Collected:** 11/09/23 16:36  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

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### SAMPLE RESULTS

**Lab ID:** L2366947-03  
**Client ID:** SVI_IA02_110923  
**Sample Location:** BRONX, NY

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#### Tentatively Identified Compounds

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### Project Information

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

### Sample Results

Lab ID: L2366947-03  
Client ID: SVL_IA02_110923  
Sample Location: BRONX, NY  
Date Collected: 11/09/23 16:36  
Date Received: 11/09/23  
Field Prep: Not Specified  
Serial No: 04172418:27

#### Volatile Organics in Air - Mansfield Lab

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#### Tentatively Identified Compounds

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**SAMPLE RESULTS**

**Lab ID:** L2366947-03  
**Client ID:** SVI_IA02_110923  
**Sample Location:** BRONX, NY

**Date Collected:** 11/09/23 16:36  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 11/14/23 00:29  
**Analyst:** RAY

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**Internal Standard**  

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## SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

**Lab ID:** L2366947-04  
**Client ID:** SVI_IA03_110923  
**Sample Location:** BRONX, NY

**Date Collected:** 11/09/23 16:02  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

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SAMPLE RESULTS

Lab ID: L2366947-04
Client ID: SVI_IA03_110923
Sample Location: BRONX, NY

Date Collected: 11/09/23 16:02
Date Received: 11/09/23
Field Prep: Not Specified

Sample Depth:

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Tentatively Identified Compounds

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## SAMPLE RESULTS

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### Project Information:

- **Project Name:** 2560-2580 BOSTON ROAD
- **Project Number:** 170684201
- **Lab Number:** L2366947
- **Report Date:** 04/17/24

### Sample Details:

- **Client ID:** SVI_IA03_110923
- **Sample Location:** BRONX, NY
- **Lab ID:** L2366947-04
- **Date Collected:** 11/09/23 16:02
- **Date Received:** 11/09/23
- **Field Prep:** Not Specified
### SAMPLE RESULTS

- **Project Name:** 2560-2580 BOSTON ROAD  
- **Project Number:** 170684201  
- **Lab Number:** L2366947  
- **Report Date:** 04/17/24

**Lab ID:** L2366947-05  
**Client ID:** SVI_AA02_110923  
**Sample Location:** BRONX, NY  
**Date Collected:** 11/09/23 15:45  
**Date Received:** 11/09/23  
**Field Prep:** Not Specified

**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/13/23 21:14  
**Analyst:** RAY

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### Volatile Organics in Air - Mansfield Lab

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### SAMPLE RESULTS

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

Lab ID: L2366947-05  
Client ID: SVI_AA02_110923  
Sample Location: BRONX, NY  
Date Collected: 11/09/23 15:45  
Date Received: 11/09/23  
Field Prep: Not Specified

**Sample Depth:**

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**SAMPLE RESULTS**

Lab ID: L2366947-05  
Client ID: SVI_AA02_110923  
Sample Location: BRONX, NY

Sample Depth:  
Matrix: Air  
Analytical Method: 48,TO-15-SIM  
Analytical Date: 11/13/23 21:14  
Analyst: RAY

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Batch Quality Control

Analytical Method:  48,TO-15 
Analytical Date:  11/13/23 15:09

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Batch Quality Control

Analytical Method: 48,TO-15  
Analytical Date: 11/13/23 15:09

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**Batch Quality Control**

**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/13/23 15:09

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#### Tentatively Identified Compounds

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### Batch Quality Control

**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 11/13/23 15:47

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#### Batch Quality Control

**Analytical Method:** 48,TO-15  
**Analytical Date:** 11/14/23 14:18

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**Batch Quality Control**

- **Analytical Method:** 48,TO-15
- **Analytical Date:** 11/14/23 14:18

**Volatile Organics in Air - Mansfield Lab for sample(s): 01-02  Batch: WG1852142-4**

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### Volatile Organics in Air - Mansfield Lab

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**Batch Quality Control**

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

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Volatile Organics in Air by SIM - Mansfield Lab

Associated sample(s): 03-05

Batch: WG1851733-3

Report Date: 04/17/24
## Lab Control Sample Analysis

### Batch Quality Control

**Project Name:** 2560-2580 BOSTON ROAD  
**Project Number:** 170684201  
**Lab Number:** L2366947  
**Report Date:** 04/17/24

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### Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Sample Depth:** Air  
**Matrix:** Air  
**Analytical Method:** 48, TO-15  
**Analytical Date:** 10/20/23 20:14  
**Analyst:** BJB

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# Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Sample Depth:**  

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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2362341  
**Report Date:** 04/17/24

**Client ID:** CAN 2186 SHELF 18  
**Date Collected:** 10/19/23 16:00  
**Date Received:** 10/20/23  
**Field Prep:** Not Specified

**Sample Location:** L2362341-02

**Sample Depth:**

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**MDL:**

- Dibromomethane: ND
- 1,2-Dichloropropane: ND
- Bromodichloromethane: ND
- 1,4-Dioxane: ND
- Trichloroethene: ND
- 2,2,4-Trimethylpentane: ND
- Methyl Methacrylate: ND
- Heptane: ND
- cis-1,3-Dichloropropene: ND
- 4-Methyl-2-pentanone: ND
- trans-1,3-Dichloropropene: ND
- 1,1,2-Trichloroethane: ND
- Toluene: ND
- 1,3-Dichloropropane: ND
- 2-Hexanone: ND
- Dibromochloromethane: ND
- 1,2-Dibromoethane: ND
- Butyl acetate: ND
- Octane: ND
- Tetrachloroethene: ND
- 1,1,1,2-Tetrachloroethane: ND
- Chlorobenzene: ND
- Ethylbenzene: ND
- p/m-Xylene: ND
- Bromoform: ND
- Styrene: ND
- 1,1,2,2-Tetrachloroethane: ND
### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Date Collected:** 10/19/23 16:00  
**Date Received:** 10/20/23  
**Field Prep:** Not Specified  
**Serial No:** 04172418:27

#### Sample Depth:

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### Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**

**Date Collected:** 10/19/23 16:00  
**Date Received:** 10/20/23  
**Field Prep:** Not Specified

**Sample Depth:**

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#### Tentatively Identified Compounds

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No Tentatively Identified Compounds
## Air Canister Certification Results

**Lab ID:** L2362341-02  
**Client ID:** CAN 2186 SHELF 18  
**Sample Location:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 10/20/23 20:14  
**Analyst:** BJB

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### Volatile Organics in Air by SIM - Mansfield Lab

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**Internal Standard**

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## Air Canister Certification Results

### Parameters

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**Lab ID:** L2363206-04  
**Client ID:** CAN 3418 SHELF 13  
**Sample Location:**

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Air Canister Certification Results

Lab ID: L2363206-04  
Client ID: CAN 3418 SHELF 13  
Sample Location:  

Sample Depth:  

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No Tentatively Identified Compounds
## Air Canister Certification Results

**Lab ID:** L2363206-04  
**Client ID:** CAN 3418 SHELF 13  
**Sample Location:**  
**Sample Depth:** Air  
**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 10/25/23 22:36  
**Analyst:** BJB  
**Date Collected:** 10/24/23 08:00  
**Date Received:** 10/25/23  
**Field Prep:** Not Specified  

### Volatile Organics in Air by SIM - Mansfield Lab

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### Volatile Organics in Air by SIM - Mansfield Lab

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## Air Canister Certification Results

### Volatile Organics in Air by SIM - Mansfield Lab

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Air Canister Certification Results

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**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:** L2363206-06

**Date Collected:** 10/25/23 11:00  
**Date Received:** 10/25/23  
**Field Prep:** Not Specified

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#### Volatile Organics in Air - Mansfield Lab

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### Air Canister Certification Results

**Project Name:** BATCH CANISTER CERTIFICATION  
**Project Number:** CANISTER QC BAT  
**Lab Number:** L2363206  
**Report Date:** 04/17/24

**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Date Collected:** 10/25/23 11:00  
**Date Received:** 10/25/23  
**Field Prep:** Not Specified

**Sample Location:**

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No Tentatively Identified Compounds
# Air Canister Certification Results

**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:**  
**Sample Depth:**  
**Matrix:** Air  
**Analytical Method:** 48,TO-15-SIM  
**Analytical Date:** 10/25/23 23:53  
**Analyst:** BJB

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### Volatile Organics in Air by SIM - Mansfield Lab

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## Air Canister Certification Results

**Lab ID:** L2363206-06  
**Client ID:** CAN 403 SHELF 2  
**Sample Location:**

### Sample Depth:

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<td>RL</td>
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<td>p-Isopropyltoluene</td>
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### Internal Standard % Recovery Qualifier Acceptance Criteria

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**Sample Receipt and Container Information**

Were project specific reporting limits specified?

YES

**Cooler Information**

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**Container Information**

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<th>Seal</th>
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*Values in parentheses indicate holding time in days*
GLOSSARY

**Acronyms**

**DL**  
Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

**EDL**  
Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

**EMPC**  
Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

**EPA**  
Environmental Protection Agency.

**LCS**  
Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

**LCSD**  
Laboratory Control Sample Duplicate: Refer to LCS.

**LFB**  
Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

**LOD**  
Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

**LOQ**  
Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

**MDL**  
Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

**MS**  
Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

**MSD**  
Matrix Spike Sample Duplicate: Refer to MS.

**NA**  
Not Applicable.

**NC**  
Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter’s reporting unit.

**NDPA/DPA**  
N-Nitrosodiphenylamine/Diphenylamine.

**NI**  
Not Ignitable.

**NP**  
Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

**NR**  
No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

**RL**  
Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

**RPD**  
Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

**SRM**  
Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

**STLP**  
Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

**TEF**  
Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

**TEQ**  
Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

**TIC**  
Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.
Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA, this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methyl naphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benzo[a]anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j+k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno[1,2,3-cd]pyrene, Dibenzo(ah)anthracene, Benzo(g,h,i)perylenes. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

DataQualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report
Data Qualifiers

ND · Not detected at the reporting limit (RL) for the sample.
NJ · Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
P · The RPD between the results for the two columns exceeds the method-specified criteria.
Q · The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
R · Analytical results are from sample re-analysis.
RE · Analytical results are from sample re-extraction.
S · Analytical results are from modified screening analysis.
V · The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)
Z · The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)
REFERENCES


LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at its own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.
The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility:
- EPA 624.1: m/p-xylene, o-xylene, Naphthalene
- EPA 625.1: alpha-Terpinol
- EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethytoluene.
- EPA 8270E: NPW: Dimethylphthalate, 1.4-Diphenyldrazine, alpha-Terpinol, Azobenzene; SCM: Dimethylphthalate, 1,4-Diphenyldrazine.
- SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility:
- SM 2540D: TSS.
- EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylphthalene.
- Non-potable Water: EPA RSK-175 Dissolved Gases
- Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:
- Drinking Water
  - EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; EPA 353.2: Nitrate-N, Nitrite-N; SM4500NO3-F: Nitrate-N, Nitrite-N; SM4500F-C, SM4500CN-CE,
  - EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B
  - EPA 524.2: THMs and VOCs; EPA 504.1: EDB, DBCP.
  - Microbiology: SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.

- Non-Potable Water
  - EPA 624.1: Volatile Halocarbons & Aromatics, EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
  - EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
  - Microbiology: SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.

Mansfield Facility:
- Drinking Water
  - EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. EPA 200.8: Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. EPA 245.1 Hg. EPA 522, EPA 537.1.

- Non-Potable Water
  - EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mn, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
  - EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
  - EPA 245.1 Hg.
  - SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.
## AIR ANALYSIS

**CHAIN OF CUSTODY**

**Client Information**
- **Client:** Langan
- **Address:** 360 W 31st Street
- **Phone:** 212-479-5400
- **Email:** Lomalum@Langan.com

**Project Information**
- **Project Name:** 2560-2580 Boston Road
- **Project Location:** Bronx, NY
- **Project #:** 170684201
- **Project Manager:** Lamees Esmail
- **ALPHA Quote #:**
- **Turn Around Time:**
  - Standard: □
  - RUSH: ●

**Date Rec'd in Lab:** 11/10/23

**Report Information - Data Deliverables**
- □ FAX
- □ EMAIL (Audit Log)
- Criteria Checker: (default based on Regulatory Criteria Indicated)
- Other Formats:
  - EMAIL (standard pdf report)
  - Additional Deliverables:

**Report To:** (if different than Project Manager)

**Regulatory Requirements/Report Limits**
- State/Fed
- Program
- Req./Comm

---

## ANALYSIS

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</table>

**SAMPLE MATRIX CODES**
- AA = Ambient Air (Indoor/Outdoor)
- SV = Soil Vapor/Sifn Gas/Gas/SVE
- Other = Please Specify

---

Please report any compounds that would be reported as tentatively identified compounds (TEQs).
APPENDIX E

DATA USABILITY SUMMARY REPORT
This memorandum presents the findings of an analytical data validation of the data generated from the analysis of air samples collected in November 2023 by Langan Engineering and Environmental Services at the 2560-2580 Boston Road site. The samples were analyzed by Alpha Analytical Laboratories, Inc. (NYSDOH NELAP registration # 11148) for volatile organic compounds (VOCs) by the methods specified below.

- VOCs by USEPA Method TO-15
- VOCs by USEPA Method TO-15 SIM

Table 1, attached, summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review.

**Validation Overview**

This data validation was performed in accordance with the following guidelines, where applicable:

- USEPA Region II Standard Operating Procedure (SOP) #HW-31, “Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15” (September 2016, Revision 6),
- USEPA Contract Laboratory Program “National Functional Guidelines for Organic Superfund Methods Data Review” (EPA 540- R-20-005, November 2020), and
- published analytical methodologies.

Validation includes review of the analytical data to verify that data are easily traceable and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator.
Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including: sample receipt documentation; analytical holding times; sample preservation; blank results (method, field, and trip); surrogate recoveries; MS/MSD recoveries and RPDs values; field duplicate RPDs, laboratory duplicate RPDs, and LCS/LCSD recoveries and RPDs. One SDG underwent Tier 1 validation review.

As a result of the review process, the following qualifiers may be assigned to the data in accordance with the USEPA’s guidelines and best professional judgment:

- **R** – The sample results are unusable because certain criteria were not met when generating the data. The analyte may or may not be present in the sample.
- **J** – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- **UJ** – The analyte was not detected at a level greater than or equal to the reporting limit; however, the reported reporting limit is approximate and may be inaccurate or imprecise.
- **U** – The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.
- **NJ** – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

If any validation qualifiers are assigned these qualifiers should supersede any laboratory-applied qualifiers. Data that is not qualified as a result of this data validation is considered acceptable on the basis of the items specified for review. Data that is qualified as “R” are considered invalid and are not technically usable for data interpretation. Data that is otherwise qualified due to minor data quality anomalies are usable, as qualified in Table 2 (attached).

The following acronyms may be used in the discussion of data-quality issues:

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<td>CCV</td>
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<td>Field Duplicate</td>
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<td>ICAL</td>
<td>Initial Calibration</td>
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<td>Internal Standard</td>
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<td>Method Detection Limit</td>
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<td>RL</td>
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<td>RPD</td>
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<td>RSD</td>
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<td>Trip Blank</td>
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<tr>
<td>UCL</td>
<td>Upper Control Limit</td>
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</table>
MAJOR DEFICIENCIES:

Major deficiencies include those that grossly impact data quality and necessitate the rejection of results. No major deficiencies were identified.

MINOR DEFICIENCIES:

Minor deficiencies include anomalies that directly impact data quality and necessitate qualification, but do not result in unusable data. No minor deficiencies were identified.

OTHER DEFICIENCIES:

Other deficiencies include anomalies that do not directly impact data quality and do not necessitate qualification. No other deficiencies were identified.

CONCLUSION:

On the basis of this evaluation, the laboratory appears to have followed the specified analytical methods with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that parameter. All of the data packages met ASP Category B requirements.

All data are considered usable, as qualified. In addition, completeness, defined as the percentage of analytical results that are judged to be valid, is 100%.

Signed:

Joe Conboy
Senior Staff Chemist
HEALTH AND SAFETY PLAN

FOR

2560 – 2580 BOSTON ROAD
BRONX, NEW YORK
Bronx Borough Tax Map
Block 4440, Lots 16, 30 and 32

Prepared For

Slate Property Group
38 East 29th Street, 9th Floor
New York, New York

Prepared By:

Langan Engineering, Environmental, Surveying
Landscape Architecture and Geology, D.P.C.
360 West 31st Street, 8th Floor
New York, New York 10001

March 2024
Langan Project No. 170684201
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1.0 INTRODUCTION

1.1 General

This HEALTH AND SAFETY PLAN (HASP) was developed to address the disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 Code of Federal Regulation (CFR) 1910.120(b)(4), Hazardous Waste Operations and Emergency Response during anticipated site work for the property located at 2560-2580 Boston Road in Allerton neighborhood of the Bronx, New York (“the Site”). The Site is identified on the Bronx Borough Tax Map as Block 4440, Lots 16, 30 and 32.

All contractors performing work on this site must implement their own HASP that, at a minimum, adheres to this HASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while onsite.

The content of this HASP may change or undergo revision based on additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The Site was first developed between 1919 and 1929 with a 2-story residential building on Lot 30. In the early 1950’s, the central portion of Lot 16 was utilized as a car sales lot and contained a small building in the western central portion of the lot. Between 1950 and 1962, Lot 16 was redeveloped with a commercial store which was situated in the northern portion of this Lot. No significant changes to the residential building on Lot 30 were identified since its first development. The Site was historically observed to be operated as an auto sales yard in the 1950’s and 1960’s. Historical aerial photographs indicated the presence of a structure in the western central portion (assumed to be the sales office) with parked vehicles surrounding the building. A site location map is provided as Figure 1.

1.3 Summary of Work Tasks

1.3.1 Geophysical Investigation

Prior to the commencement of intrusive field activities (i.e., soil borings); a geophysical consultant may conduct a geophysical survey using ground penetrating radar (GPR) and electromagnetic detection equipment. Langan personnel will coordinate the geophysical survey. The objective of the survey will be to identify any underground storage tank (UST) structures, drains, underground utilities, and other subsurface anomalies that may be encountered during the
investigation. During this time Langan personnel will inspect the site and confirm sample locations.

1.3.2 Hand Clearing of Borehole Locations

If there is no geophysical survey for utility clearance or the results of the geophysical survey are inconclusive at specific locations subject to intrusive work, the contractor may hand clear each location to confirm utilities or other known or suspected subsurface structures. Hand clearing of a soil boring location should extend to a depth of 5-feet and be about 1.5 times the anticipated diameter of the borehole when drilled. Langan personnel will confirm that hand clearing activities are completed to these specifications.

1.3.3 Soil Investigation and Sampling

Langan will retain a drilling contractor to advance soil borings to a depth below grade surface (bgs) specified in the work plan. Borings will be installed at the approximate locations indicated in Langan’s work plan but may be moved in the field based on utility clearance and accessibility. The drilling contractor will contact the appropriate utility mark-out authority and make available to their drilling staff the verification number and effective dates. Langan will record the verification number and effective dates from the drillers. Langan will also note the location of marked out utilities on the site plan and scan the data into the project folder.

Langan personnel will screen soil for visual, olfactory, and instrumental indicators suggestive of a potential petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a duly field-calibrated photoionization detector (PID) (or equivalent). Langan personnel will collect soil samples from the proposed soil boring locations following the sampling plan outlined in the work plan. The borings will be filled with clean soil cuttings, clean sand or bentonite grout and capped at grade to match the surrounding surface after samples are collected.

Soil samples will be submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.4 Groundwater Investigation and Sampling

Selected soil borings will be converted into groundwater monitoring wells and sampled to evaluate groundwater quality. Groundwater samples will be collected from one or more of the new and if available, pre-existing monitoring wells in accordance with the Langan Low Flow Groundwater Sampling SOP (SOP #12). Groundwater samples will be submitted to an approved
laboratory and analyzed for constituents as specified in the work plan. Temporary monitoring wells will be plugged and abandoned during the investigation in the manner defined in Section 1.3.2 for soil boring. Permanent monitoring wells will be completed with a road box set in concrete. Permanent monitoring wells will be eventually backfilled and abandoned in accordance with State and Local regulations.

Groundwater samples will be submitted to a NYSDOH ELAP-certified laboratory and analyzed in accordance with work plan specifications.

### 1.3.5 Groundwater/Product Gauging

Langan may gauge one or more of the observation/monitoring wells to collect synoptic head data or determine the presence of product. When gauging, Langan may also survey head space VOCs within the well using a duly calibrated PID. When collected, gauging data will be based on the northernmost point at top of casing (TOC) using an interface probe (IP) capable of determining the presence of free product in the monitoring well as light non-aqueous phase liquid (LNAPL) at the top of the water column. If gauging for dense non-aqueous phase liquid (DNAPL) at the base of the monitoring well, the IP may not be appropriate. The field engineer will coordinate with the project team to devise an alternative method to gauge the thickness of DNAPL at base of the well. Langan will decontaminate gauging equipment between wells as required by the work plan.

### 1.3.6 Product Bailing

Langan may remove free product from on-site monitoring wells as part of this HASP or subsequent SMP activities. Langan will may use a bailer, peristaltic pump or submersible as determined by the work plan. Langan will record the volume of product and groundwater recovered. Recovered product and groundwater will be drummed in accordance with procedures outlined in the work plan.

### 1.3.7 Sub Slab or Soil Vapor Point Installation and Sampling

Langan (or its contractor) will install one or more sub-slab or soil vapor points at selected locations. If installed, the sub-slab points will be set at or just below the bottom of the slab in accordance with the work plan. The sub-slab points may be installed using an electric hammer drill to advance small diameter borings through the concrete (or equivalent) slab as defined in the work plan. The borings will terminate in and sample from the gravel substrate below the slab. Conditions in the field may require adjustment of sampling locations.

Langan personnel (or contractor) may install VaporPin® vapor points (or equivalent) in accordance
with the manufacturer’s instructions. If no point is used, Langan (or contractor) will set a sampling tube defined as an open-ended Teflon™-lined polyethylene tubing (or equivalent tubing as approved by the project manager [PM]). The sampling tube will be set either within the base of the concrete slab or within the support gravel underlying the slab.

When using the VaporPin® or equivalent, the installation sleeve will provide the necessary annulus seal required for subsequent sampling. However, if a sampling tube as defined above is used, the annulus at the top of the concrete slab will be filled with bentonite or food grade clay to seal the slab. A sand pack is not required for sub-slab vapor sampling. Unless specified by the work plan, the sub slab points are temporary and will be pulled after the sampling event and the hole will be patched at grade with material similar to the surrounding surface.

Langan personnel will confirm that the soil vapor points (implants) are 2-inches in length constructed of polyethylene material and are connected to the surface by Teflon™-line polyethylene material (equivalent materials for the point and tubing are acceptable as approved by the PM). The annulus around the implant will be filled with clean sand to 6-inches above the implant. A 1-foot bentonite slurry will be applied to the top of the sand up to seal the sampling points. The remaining soil vapor point annulus may be backfilled with clean cuttings are sand to grade. Unless specified by the work plan, the vapor points are temporary and will be pulled after the sampling event and the hole will be patched at grade with material similar to the surrounding surface.

Vapor samples will be collected in accordance with following guidance including Final Guidance for Evaluating Soil Vapor Intrusion published by the New York State Department of Health (NYSDOH) in October 2006, with updates February 2024, and Langan’s Sub-Slab Vapor Sampling SOP (SOP #14) and as specified in the work plan. In addition, ambient air and indoor air samples may be collected for use as a comparison sample. As part of the indoor air sampling program, Langan personnel may complete a building inventory inspection. The inspection may take place prior to the commencement of actual field sampling. Vapor samples may be submitted to a NYSDOH ELAP-certified laboratory and analyzed in accordance with work plan specifications or to another laboratory as specified by the client.

### 1.3.8 Observation/Monitoring Well Plugging and Abandonment

At an unspecified future date, the observation/monitoring wells will be abandoned. Plugging and abandonment will be in accordance with federal and state requirements. Langan may retain a drilling contractor to complete the plugging and abandonment activities. The contractor will contact the appropriate utility mark-out authority and make available to their field staff the verification number and effective dates. Langan may observe the plugging and abandonment of one or more observation/monitoring wells to document that the plugging and abandonment
activities were completed in accordance with the work plan and regulations.

1.3.9 QA/QC Sampling

Samples for quality assurance/quality control [QA/QC] samples may also be collected and submitted to an approved laboratory and analyzed in accordance with work plan specifications. Information regarding the QA/QC samples including required method of analysis may be included in the same COC as the soil samples unless otherwise instructed by the work plan.

1.3.10 Equipment Decontamination

Before the start of the day’s sampling and after sampling each run, sampling equipment will be decontaminated by the decontamination process outlined Attachment B - Decontamination Procedures. Decontamination wastes and purge water will be temporarily stored on site pending analytical results.

1.3.11 Management of Investigative-Derived Waste

The investigative-derived waste (IDW) generated during this investigation will be contained in DOT-approved 55-gallon drums. The drums will be temporarily stored on the site or as directed by the client representative. All drums will be filled between to two-thirds full to allow easy maneuvering during drum pickup and disposal. Drum labels are to be provided by Langan (Environmental Closet). All drums will be labeled as “IDW Pending Analysis” until sample data are reported from the laboratory. Drum labels will include date filled and locations where waste was generated along with the standard information required by the labels in accordance with the Langan SOP09, Drum Labeling.

Closed top drums are to be used to store liquids. Debris, including plastic sheeting, polyethylene tubing, personal protection equipment (PPE), decontamination debris, etc. will be segregated from and disposed in large heavy duty garbage bags and disposed of at the site. Excess unused glassware should be returned to the lab along with the last day of collection samples.

1.3.12 Drum Sampling

Langan personnel may collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to an approved laboratory and analyzed in accordance with work plan specifications, if required.

1.3.13 Surveying

Surveying activities may be completed by Langan. Surveying will be conducted by licensed
2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this site. The titles have been established to accommodate the project needs and requirements and ensure the safe conduct of site activities. The H&S personnel requirements for a given work location are based on the proposed site activities.

2.1 Langan Project Manager

The Langan Environmental Project Manager (PM) is Lamees Esmail; her responsibilities include:

- Ensuring that this HASP is developed, current, and approved prior to on-site activities.
- Ensuring that the tasks in the project are performed in a manner consistent with Langan’s comprehensive Health and Safety Program for Hazardous Waste Operations and this HASP.

2.2 Langan Corporate Health and Safety Manager

The Langan Corporate Health and Safety Manager is Tony Moffa. His responsibilities include:

- Assisting the site Health and Safety Officer (HSO) with the development of the HASP, updating HASP as dictated by changing conditions, job site inspection results, etc., and approving changes to this HASP.
- Assisting the HSO in the implementation of this HASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

The Langan site HSO is William Bohrer. His responsibilities include:

- Participating in the development and implementation of this HASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
• Ensuring that proper PPE is available, worn by employees, and properly stored and maintained.
• Controlling entry into and exit from the site contaminated areas or zones.
• Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
• Monitoring site hazards and conditions.
• Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
• Resolving conflicts that may arise concerning safety requirements and working conditions.
• Reporting all incidents, injuries, and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is Meghan Aronica. The Field Team Leader’s responsibilities include:

• The management of the day-to-day site activities and implementation of this HASP in the field.
• Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
• When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintain community air monitoring activities and instruct the responsible contractor to implement organic vapor or dust mitigation when necessary.
• Overseeing the implementation of activities specified in the RAP.

2.5 Contractor Responsibilities

The contractor must develop and implement their own HASP for their employees, their subcontractors, and consultants. The contractor is responsible for their own health and safety and that of their subcontractors. Contractors operating on the site must designate their own FTL, HSO, and Health and Safety Manager (HSM). The contractor’s HASP will be at least as stringent as this HASP. The contractor must be familiar with and abide by the requirements outlined in their own HASP. A contractor may elect to adopt Langan’s HASP as its own provided that it has given written notification to Langan, but where Langan’s HASP excludes provisions pertinent to the contractor’s work (i.e., confined space entry); the contractor must provide written addendums to this HASP. Additionally, the contractor must:

• Ensure their employees are trained in the use of all appropriate PPE for the tasks involved.
• Notify Langan of any hazardous material brought onto the job site or site-related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material.
• Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertaining to the work.
• Ensure their employees handling hazardous materials, if identified at the Site, have received current training in the appropriate levels of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) if hazardous waste is identified at the Site.
• Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type of respirator they will wear; and
• Ensure all air monitoring is in place pertaining to the health and safety of their employees as required by OSHA 1910.120; and
• All contractors must adhere to all federal, state, and local regulatory requirements.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be encountered at the Site. The potential contaminants that might be encountered during the field activities and the exposure limits are listed in Table 2 complete inventory of MSDS/SDS for chemical products used on site is included in Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Work Zone Vapor Monitoring

The work scope may require drilling in locations where there may be a potential for exposure to concentrations of select VOCs including 2,2,4-Trimethylpentane based on initial soil vapor sampling data; 2,2,4-Trimethylpentane is flammable additive to gasoline.to prevent engine knocking. Therefore, the work scope will require continuous monitoring of work zone atmospheric VOCs and lower explosion limits (LEL) using a five-gas multimeter (MultiRAE or equivalent).

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for 2,2,4-Trimethylpentane is 500 ppm. Langan will monitor atmospheric VOCs. If VOCs atmospheric concentration exceed 5 ppm, Langan will cease operations and relocate off-site. The Langan field engineer will inform the Langan Environmental PM of the situation.

If the LEL alarm sounds, the Langan engineer will instruct the contractor to shut off all operating equipment (electrical and mechanical) and relocate off-site. The Langan field engineer will inform
the Langan Environmental PM of the situation.

3.1.2 Geophysical Survey

Langan personnel are not permitted to operate or otherwise handle the geophysical equipment including any downhole geophysical equipment subsequently used to survey boreholes. When boring locations are surveyed with surface geophysical equipment, the locations of the borings as well as utilities and other artifacts that may interfere with the subsurface investigation are to be marked with indelible paint, flags, or color tape (when marking indoor locations that the client has specifically requested not be marked with indelible paint). This information must also be added to the site map. When applying paint, proper PPE including hand protection should be used.

3.1.3 Hand Clearing of Borehole Locations

Hand clearing will be completed by the contractor. Langan personnel are not permitted to operate or otherwise handle the contractor equipment. Langan will update the site map to include the locations of the cleared borehole locations as well as utilities and other artifacts that may interfere with the subsurface investigation.

3.1.4 Soil Investigation and Sampling

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate drilling or excavation equipment nor open sampling devices (acetate liners, sonic sample bags, etc.). These tasks are to be completed by the driller or excavation contractor.

3.1.5 Indoor Drilling and Excavation

The work scope may require indoor drilling or drilling in locations where there may not be adequate ventilation sufficient to safely operate any rig or excavation equipment powered by an internal combustion engine. Where possible, all such work should be done by equipment powered by electricity. If such equipment is used and must be directly wired to the buildings electrical system or to an independent system, this work must be completed by a licensed electrician in accordance with all electrical codes applicable to the work.

Indoor work which is to be completed with equipment powered by an internal combustion engine must incorporate air monitoring of carbon monoxide (CO) using calibrated air monitoring equipment (MultiRAE or equivalent). In addition, the work plan should incorporate mitigation for venting engine exhaust fumes directly to the outdoors and for circulating fresh air into the work
area.

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for CO from 50 to 35 parts per million (ppm). Langan will monitor CO with a suitable monitoring device. If CO levels exceed 5 ppm, Langan will instruct contractors to begin mitigation measures. These measures are at a minimum:

- Increase air circulation using industrial size fans to bring additional fresh air into the building or vent exhaust to the outside.
- Modify the passive exhaust method being used to increase venting circulation by using wider diameter tubing or sealing tubing connections; or
- Modify the work schedule where the rig is turned off to allow time for CO levels to fall back to background.

All work must cease if CO levels reach 35 ppm. The Langan engineer is to report to the PM and H&S officer when an action level is reached.

### 3.1.6 Groundwater Investigation and Sampling

Sampling groundwater requires the donning of chemical resistant gloves in addition to the standard PPE and cut resistant gloves when cutting sampling-tubing to length. Langan personnel are not to operate drilling equipment nor assemble or install monitoring well equipment. These tasks are to be completed by the driller contractor.

### 1.3.7 Groundwater/Product Gauging

Gauging product requires additional safety considerations including the presence of VOCs and protection of both field cloths and property. Langan will monitor air for VOCs using a duly calibrated PID. Langan will don protective clothing including Tyvek® over-cloths, as necessary. To protect property, Langan will work set a plastic barrier to protect floors or protect landscaping and use absorbent pads as necessary to collect pooled product. If sampling for PFAS from the same well, Langan will complete the product check first, if the well can be sampled without including product, Langan will remove the Tyvek® material from the well head vicinity.

### 3.1.8 Product Recovery Well Bailing

Langan may bail free product from monitoring wells. Free product bailing requires the donning of Tyvek™ suits, Tyvek™ boots and chemical resistant gloves in addition to the standard PPE and cut resistant gloves when cutting sampling-tubing to length. In addition, Langan will place plastic sheeting around the recovery well head to control spillage during product recovery.
Langan will also keep on hand and readily available product absorbing pads to use as needed.

### 3.1.9 Electrical Pumps

Langan may use an electric pump to collect product from the recovery wells or to sample groundwater. Langan will inspect the electric pump and control box prior to use and specifically note the condition of the electrical connectors, pump, control box and the electrical cord. The electrical connection must be a grounded and connect to the power source using a functional three prong grounded plug. The power source must be a Ground Fault Circuit Interrupter (GFI or GFCI) receptacle.

### 3.1.10 Plugging and Abandonment of Observation/Monitoring Wells

Langan personnel are not to operate equipment nor assist in the plugging and abandonment of the observation/monitoring wells. These tasks are to be completed by the contractor.

### 3.1.11 Electric Hammer Drill

Langan or the contractor may use an electric hammer drill to install the sub slab vapor points. Langan will confirm that hammer drill and all extension cords are inspect prior to use. The electrical cords must be a grounded and connect to the power source using a functional three prong grounded plug. The power source must be a Ground Fault Circuit Interrupter (GFI or GFCI) receptacle. Langan will confirm that there is a portable GFCI circuit from the outlet to the extension cord and that the GFCI is tested before commencing drilling activities.

### 3.1.12 Vapor Investigation and Sampling

Sampling vapor requires the donning of work gloves in addition to the standard PPE when assembling the Summa™ canister with the regulator and cut resistant gloves when cutting sampling- or silicone-tubing to length. Langan personnel are not to operate contractor equipment nor assemble or install the contractor vapor point sampling equipment unless instructed by the work plan. When not instructed by the work plan, these tasks are to be completed by the contractor.

### 3.1.13 Additional Vapor Screening

Langan personnel may prescreen vapor samples for volatile organic compounds (VOCs), methane, hydrogen sulfide and lower explosion limit (LEL) conditions using duly calibrated devices design to screen vapor for these parameters. Langan personnel may also perform atmospheric screening for LEL. Results of the screening may be used in determining which soil
vapor samples will be submitted for analysis.

Work activities will immediately cease, and the work area is to be evacuated if the MultiRAE returns a reading of 10% of the LEL (an alarm will sound). Langan personnel will contact the Langan PM. Instrument action levels for monitored gases are provided in Table 4.

3.1.14 Drum Sampling

Drilling fluid, rinse water, grossly contaminated soil samples and cuttings will be containerized in 55-gallon drums for disposed off-site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Sampling drums requires the donning of work gloves when opening the drums and chemical resistant gloves when sampling in addition to standard PPE.

Langan personnel and contractors are not to move or opened any orphaned (unlabeled) drum found on the site without approval of the project manager.

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 1.

3.3.1 Explosion

No explosion hazards are expected for the scope of work at this site.

3.3.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72°F or above. Table 6 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to Table 7 to assist in assessing when the risk for heat-related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the HSO or the FTL, who must be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:
• **Heat Cramps**: Painful spasms of arm, leg, or abdominal muscles, during or after work

• **Heat Exhaustion**: Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature

• **Heat Stroke**: Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. *This is a life-threatening condition.*

Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

• **Heart rate**: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100-beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100-beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100-beats per minute.

• **Oral temperature**: Use a clinical thermometer (3 minutes under the tongue) or a similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6°F. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat-related illnesses. To avoid heat-stress the following steps should be taken:

• Adjust work schedules.

• Mandate work slowdowns as needed.

• Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

• Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

• Maintain worker’s body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal the amount of
water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for every eight ounces (0.23 kilograms [kg]) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature 50° to 60°F (10° to 16.6°C).
- Provide small disposal cups that hold about four ounces (0.1-liters).
- Have workers drink 16-ounces (0.5-liters) of fluid (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15- to 20-minutes, or at each monitoring break. A total of 1- to 1.6-gallons (4- to 6-liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat-related illness.

### 3.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is called frostbite.

- **Hypothermia** - Hypothermia is defined as a decrease in the patient core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include shivering, apathy, listlessness, sleepiness, and unconsciousness.

- **Frostbite** - Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

**Prevention of Cold-Related Illness** - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia.
- Identify and limit known risk factors:
  - Assure the availability of an enclosed, heated environment on or adjacent to the site.
  - Assure the availability of dry changes of clothing.
  - Assure the availability of warm drinks.
• Start (oral) temperature recording at the job site:
• At the FSO or Field Team Leader’s discretion when suspicion is based on changes in a worker’s performance or mental status.
• At a worker’s request.
• As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
• As a screening measure whenever anyone worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

3.3.4 Noise

Work activities during the proposed activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used, as necessary.

3.3.5 Hand and Power Tools

The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut, or struck by the tool, fire, and electrocution. All hand and power tools should be inspected for health and safety hazards prior to use. If deemed unserviceable/un-operable, notify the supervisor and tag equipment out of service. Ground Fault Circuit Interrupters (GFCIs) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips, and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the site, with hazards communicated to all workers in the area.

3.3.7 Utilities (Electrocution and Fire Hazards)

3.3.7.1 Utility Clearance

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by a review of available utility drawings and by notification of the subsurface work to N.Y. One–Call–Center.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns, arc flashes, and electrocution, which could result in serious injury including death. Therefore, there is a procedure that
establishes the requirements for the lockout/tag out (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29CFR1910.147 and 29 CFR 1926.417. This procedure will be used to ensure that all machines and equipment are isolated from potentially hazardous energy. If possible, equipment that could cause injury due to unexpected energizing, start-up, or release of stored energy will be locked/tagged, before field personnel performs work activities.

The facility owner/operator/representative is to be the authorized person that will initiate and perform the LOTO in accordance with applicable rules and practices. Inerting of electrical power sources is to be completed by an authorized and licensed electrician. Langan personnel will follow LOTO protocols and practices including adding a separate lock/signature to the LOTO chain in accordance with said protocols and practices.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at the surface, subsurface, and overhead locations are energized until equipment has been designated and confirmed as de-energized by a utility company representative. Langan will notify the designated utility representative prior to working adjacent to this equipment and will verify that the equipment is energized or de-energized in the vicinity of the work location. No project work shall be performed by Langan personnel or subcontractors near energized electrical lines or equipment.

The FTL shall accompany the designated facility owner/operator/representative or authorized/licensed electrician in surveying to locate and identify all energy-isolating devices. Langan will note which switches, valves or other isolating devices are used for inerting the equipment and how they are set assuring LOTO. The lockout/tagout procedure involves, but is not limited to, electricity, motors, steam, natural gas, compressed air, hydraulic systems, digesters, sewers, etc.

3.3.8 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the Site. The following physical hazards should be considered when handling materials at the Site:

- Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible.
- The mechanical devices will be appropriate for the lifting of moving tasks and will be operated only by trained and authorized personnel.
- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.
• Lifting devices will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed.
• The wheels of any trucks being loaded or unloaded will be choked to prevent movement. Outriggers will be fully extended on a flat, firm surface during operation.
• Personnel will not pass under a raised load, nor will a suspended load be left unattended.
• Personnel will not be carried on lifting equipment unless it is specifically designed to carry passengers.
• All reciprocating, rotating, or other moving parts will be guarded at all times.
• Accessible fire extinguishers, currently (monthly) inspected, will be available in all mechanical lifting devices.
• Verify all loads/materials are secure before transportation.

Material handling tasks that are unusual or require specific guidance will need a written addendum to this HASP. The addendum must identify the lifting protocols before the tasks are performed. Upon approval, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by the Langan HSM.

3.3.9 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 A-weighted decibels (dBa) (8-hour TWA), and noise levels in excess of 90-dBa must be reduced through feasible administrative and engineering controls. (20 CFR 1926.52). Hearing protection is required when working within 15-feet of vacuum extraction equipment and drill rigs.

3.3.10 Open Water

Employees working over or near water, where the danger of drowning exists, must be provided with U.S. Coast Guard-approved life jackets or buoyant work vests. Prior to and after each use, the buoyant work vests or life preservers must be inspected for defects that would alter their strength or buoyancy. Defective units must not be used.

And should a worker fall into the water, OSHA requires (29 CFR 1926.106(c)) that ring buoys with at least 90-feet of the line must be provided and readily available for emergency rescue operations. The distance between ring buoys must not exceed 200-feet. Another remedial action required by OSHA (29 CFR 1926.106(d)) is the use of lifesaving skiffs.

OSHA requires that at least one lifesaving skiff must be immediately available at locations where employees are working over or adjacent to water and must include the following provisions.
• The skiff must be in the water or capable of being quickly launched by one person.
• At least one person must be present and specifically designated to respond to water emergencies and operate the skiff at all times when there are employees above water.
• When the operator is on break another operator must be designated to provide requisite coverage when there are employees above water.
• The designated operator must either have the skiff staffed at all times or have someone remain in the immediate area such that the operator can quickly reach the skiff and perform rescue services.
• The skiff operator may be assigned other tasks provided the tasks do not interfere with the operator’s ability to quickly reach the skiff.
• A communication system, such as a walkie-talkie, must be used to inform the skiff operator of an emergency and to inform the skiff operator where the skiff is needed.
• The skiff must be equipped with both a motor and oars.

With regard to the number of skiffs required and the appropriate maximum response time, the following factors must be evaluated:

• The number of work locations where there is a danger of falling into water.
• The distance to each of those locations.
• Water temperature and currents.
• Other hazards such as, but not limited to, rapids, dams, and water intakes.

Other regulations that present H&S practices and PPE for work on or near water include: 29 CFR 1910, Subpart T (401 – 440)

3.4 Biological Hazards

3.4.1 Animals

There is a possibility of encountering wildlife including reptiles, rodents, and other small and medium-size mammals. The Langan personnel is to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After fieldwork, Langan personnel should perform a complete visual inspection of their clothing to insure they are not inadvertently harboring ticks. If they do observe a tick bite, they are to contact the HSM or HSO and report the event.
3.4.3 Plants

Poisonous plants may be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and applying preventative poison Ivy/Sumac lotion to prevent or limit the effects of exposure. If after fieldwork, Langan employees do observe a reaction to poisonous plant exposure, they are to contact the HSM or HSO and report the event.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or ground water from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e., MultiRAE). However, in oxygen-depleted atmospheres (confined space), only an LEL designed to work in low-oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallon drums.

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled, or minimized. A JSA will be
performed at the beginning of each workday, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA’s 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10-hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this HASP. For a HAZWOPER operation, training on the site must be for a minimum of 3 days. Specific issues that will be addressed include the hazards described in Section 3.0.

4.3 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan HSO will conduct a brief tailgate safety meeting to assist site personnel in conducting their activities safely. Tailgate meetings will be documented in Attachment H. Briefings will include the following:

- Work plan for the day.
- Review of safety information relevant to planned tasks and environmental conditions.
- New activities/tasks being conducted.
- Results of Jobsite Safety Inspection Checklist.
- Changes in work practices.
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.
5.0 MEDICAL SURVEILLANCE

All personnel who will be performing fieldwork involving potential exposure to toxic and hazardous substances (defined by 29 CFR 1910.120(a)) will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine.

Additionally, personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), Respiratory Protection. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Results of medical evaluations are maintained by the HSM.

5.1 Mercury Monitoring

Langan includes medical monitoring for mercury during the initial baseline and annual physical.

5.2 Coronavirus

General Preventative Measures

Field personnel must follow general proper hygiene measures while in the field including:

- Avoid touching eyes, nose, and mouth.
- Cover coughs or sneezes with tissue and throw in the trash.
- Wash hands often with soap and water for 20 seconds after going to the bathroom, before eating, after blowing nose, coughing, or sneezing.
- Use hand sanitizer with at least 60% alcohol if soap and water are not available.
- Avoid physical contact with other people (e.g., no handshakes).
- Maintain a safe distance of at least six feet from other people (social distancing).
- Wear face coverings when around other workers to minimize the spread of COVID-19. (May be required in certain states or locations.)

Construction Trailers

Employees should avoid the use of shared construction trailers or where employees cannot maintain a safe distance (minimum 6-feet) from other workers. If trailer use is needed, areas such as desks, phones, chairs, and other common areas, should be cleaned and disinfected before and after use. Protocols should be developed to minimize trailer use to essential personnel, restrict use from any workers who are ill or showing symptoms of being ill, use face coverings and ensure a safe distance of six feet can be established between workers.
Communication

Include Coronavirus topics and prevention topics in daily tailgate meetings to ensure Coronavirus awareness is communicated daily. Discussions can focus on general topics including social distancing, prevention measures for field personnel, signs and symptoms, and recent news on the Coronavirus. Site-specific topics should include minimizing face-to-face contact, disinfecting/sterilizing field equipment, use of PPE to reduce exposure, site security, use of face coverings, and other potential exposure issues/concerns.

Sick/Ill Workers

No Langan employee is permitted to be onsite when ill and/or showing potential symptoms of the Coronavirus. Symptoms of the Coronavirus may appear 2-14 days after exposure and can range from mild to severe. The most common symptoms include fever, fatigue, dry cough, shortness of breath chills, repeated shaking with chills, muscle pain, headache, sore throat, or new loss of taste or smell. If an employee or subcontractor is observed being ill or exhibiting symptoms of Coronavirus, employees must immediately utilize their Stop Work Authority and contact their project manager to address the situation. If an employee observes another worker onsite exhibiting symptoms of Coronavirus, immediately utilize Stop Work Authority, notify their project manager, and site construction manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Levels of Protection

Langan will provide PPE to Langan employees to protect them from the specific hazards they are likely to encounter on-site. Directly hired contractors will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Human exposure to contaminants found in the subsurface can occur through three primary routes:

- Inhalation of gases, vapors, dust, or mists is a common route of exposure. Chemicals can enter and irritate the airways and the lungs. They can become deposited in the airways or can be absorbed through the lungs into the bloodstream.
- Direct contact of contaminants with the skin or eyes is a common route of exposure.
Some substances are absorbed through the skin and can enter the bloodstream. Broken, cut, or cracked skin will allow substances to enter the body more easily.

- Ingestion or swallowing of food, drink, or other substances is the third route of exposure. Chemicals that get in or on food, utensils, or hands can be ingested. Substances can be absorbed into the blood.

Based on anticipated site conditions and the proposed work activities to be performed at the site, Level D protection will be used. The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 6.0 (when applicable). The decision to modify standard PPE will be made by the site HSO or FTL after conferring with the PM. The levels of protection are described below.

**Level D Protection (as needed)**

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes
- Coveralls (Tyvek® or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection
- Reflective safety vest

**Level D Protection (Modified, as needed)**

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers.
- Coveralls (poly-coated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater, or non-aqueous phase liquids is anticipated)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection (as needed)
- Personal floatation device (for work within 5 ft of the water)
- Reflective traffic vest

**Level C Protection (as needed)**

- Full or Half face, air-purifying respirator, with NIOSH approved High-Efficiency
Particulate Air (HEPA) filter.

- Inner (latex) and outer (nitrile) chemical-resistant gloves
- Safety glasses with side shields or chemical splash goggles
- Chemical-resistant safety boots/shoes
- Hard hat
- Long sleeve work shirt and work pants
- Coveralls (Tyvek® or equivalent)
- Hearing protection (as needed)
- Reflective safety vest

The action levels used in determining the necessary levels of respiratory protection and upgrading to Level C are summarized in Table 4. The written Respiratory Protection Program is maintained by the HSM and is available if needed. The monitoring procedures and equipment are outlined in Section 6.0 (when applicable).

6.2 Respirator Fit-Test

All Langan employees who may be exposed to hazardous substances at the work site must be in possession of a full or half face piece air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

6.3 Respirator Cartridge Change-Out Schedule

Respiratory protection is required to be worn when certain action levels (Table 2) are reached. A respirator cartridge change-out schedule has been developed to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges must be removed and disposed of at the end of each shift when cartridges become wet or the wearer experiences a breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges must be removed and disposed of after 4 hours of use.

Respirators must not be stored at the end of the shift with contaminated cartridges left on. Cartridges must not be worn on the second day, no matter how short the time period was the previous day they were used.
7.0 AIR QUALITY MONITORING AND ACTIONS LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results may be collected and used to provide data to determine when exclusion zones need to be established and when certain levels of personal protective equipment are required. For all instruments, there are Site-specific action-level criteria that are used in making field health and safety determinations. Other data, such as the visible presence of contamination or the steady state nature of air contaminant concentration, are also used in making field health and safety decisions. Therefore, the HSO may establish an exclusion zone or require a person to wear a respirator even though atmospheric air contaminant concentrations are below established HASP action levels.

During site work involving disturbance of petroleum-impacted or fill material, real-time air monitoring may be conducted for methane and VOCs. A MultiRAE LEL/Oxygen (O2) meter and FID will be used to monitor the LEL of methane, and a PID and/or FID will be used to monitor concentrations of VOCs at personnel breathing-zone height. Air monitoring will be the responsibility of the HSO or designee. Air monitoring may be conducted during intrusive activities associated with the completion of excavation, debris removal, and soil grading. All manufacturers’ instructions for instrumentation and calibration will be available onsite.

Subcontractors’ air monitoring plans must be equal to or more stringent than the Langan plan.

An air monitoring calibration log is provided in Attachment D of this HASP.

7.1.1 Volatile Organic Compounds

Monitoring with a PID, such as a MiniRAE 2000 (10.6v) or equivalent may occur during intrusive work in the Areas of Concern (AOCs). Colorimetric Indicator Tubes for benzene may be used as a backup for the PID if measurements remain above background monitor every 2 hours. The HSO will monitor the employee’s breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (odors, visible gases, etc.) since the last measurement. If VOC levels are observed above 5 ppm for longer than 5 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 Metals

Based upon the site historical fill, there is a potential for the soils to contain Polycyclic Aromatic Hydrocarbons (PAHs) and metals. During invasive procedures which have the potential for creating airborne dust, such as excavation of dry soils, a real-time airborne dust monitor such as
a Mini-Ram may be used to monitor for air particulates. The HSO will monitor the employee’s breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (appearance of visible dust) since the last measurement. If dust levels are observed to be greater than 0.100 milligrams per cubic meter (mg/m$^3$) or visible dust is observed for longer than 15 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring are provided in Table 4.

7.1.3 Methane

During soil excavation or other intrusive activities, direct reading air monitoring will be performed in the excavation area to determine exposure to workers. Monitoring with an LEL/O2 meter and FID may occur during intrusive work in the AOCs. The HSO will monitor the employee’s breathing zone at least hourly during intrusive activities. If LEL levels are observed above 20% the professional engineer (PE) or their designee will stop work and evacuate the area; warn others; and determine source of readings and take corrective actions. The Contractor will be responsible for mitigating explosive gas levels.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration must be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments must be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument responses.

All instruments must be operated in accordance with the manufacturers’ specifications. Manufacturers' literature, including an operation manual for each piece of monitoring equipment, will be maintained on-site by the HSO for reference.

7.3 Determination of Background Levels

Background (BKD) levels for VOCs, dust, and methane will be established prior to intrusive activities within the AOC at an upwind location. A notation of BKD levels will be referenced in the daily monitoring log. BKD levels are a function of prevailing conditions. BKD levels will be taken in an appropriate upwind location as determined by the HSO.

Table 4 lists the instrument action levels.
8.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring may be conducted in compliance with local standards. If conducted, Langan will implement the generic CAMP outlined below amended to comply with local conditions or standards:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring of the perimeter of the work zones for odor, VOCs, and dust may be required for all ground intrusive activities such as soil excavation and handling activities. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling and soil excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements (if required). When required, particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the local standards or, default to the performance standards below:

If VOC monitoring is required, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps work activities will resume provided that the total organic vapor level is 200-feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20-feet, is below 5 ppm above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shut down.

If dust monitoring with field instrumentation is required, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100-micrograms per cubic meter (µg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind particulate matter less than
10 microns (PM10) levels do not exceed 150 µg/m³ above the background level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m³ above the background level, work must be stopped, and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

8.1 Dust Suppression Techniques

Preventative measures for dust generation may include wetting site fill and soil, construction of an engineered construction entrance with a gravel pad, a truck wash area, covering soils with tarps, and limiting vehicle speeds to five miles per hour.

Work practices to minimize odors and vapors include limiting the time that the excavations remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include direct load-out of soils to trucks for off-site disposal; use of chemical odorants in spray or misting systems; and use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

9.0 WORK ZONES AND DECONTAMINATION

9.1 Site Control

Work zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas.

Any person working in an area where the potential for exposure to site contaminants exists will only be allowed access after providing the HSO with proper training and medical documentation.
Exclusion Zone (EZ) - All activities which may involve exposure to site contaminants, hazardous materials, and/or conditions should be considered an EZ. Decontamination of field equipment will also be conducted in the Contaminant Reduction Zone (CRZ) which will be located on the perimeter of the EZ. The EZ and the CRZ will be delineated by cones, tapes, or other means. The HSO may establish more than one EZ where different levels of protection may be employed, or different hazards exist. The size of the EZ must be determined by the HSO allowing adequate space for the activity to be completed, field members, and emergency equipment.

9.2 Contamination Zone

9.2.1 Personnel Decontamination Station

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure.

9.2.2 Minimization of Contact with Contaminants

During the completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and another physical contact with contamination as PPE is intended to minimize accidental contact. This may minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control spray and runoff and to ensure that unprotected personnel working nearby are not affected.

9.2.3 Personnel Decontamination Sequence

Decontamination may be performed by removing all PPE used in EZ and placing it in drums/trash cans at the CRZ. Baby wipes should be available for wiping hands and face. Drums/trash cans will be labeled by the field crews in accordance with all local, state, and federal requirements. Management plans for contaminated PPE, and tools are provided below.

9.2.4 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be decontaminated by site personnel as described above before emergency responders handle the victim. If the person cannot be moved because of the extent of the injury (a back or neck injury), provisions must be made to ensure that emergency response personnel
will be able to respond to the victim without being exposed to potentially hazardous atmospheric conditions. If the potential for inhalation hazards exists, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel should be immediately informed of the injured person’s condition, and potential contaminants, and provided with all pertinent data.

9.2.5 Hand-Held Equipment Decontamination

Hand-held equipment includes all monitoring instruments as stated earlier, samples, hand tools, and notebooks. The hand-held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the CRZ.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using wipes or paper towels if contamination is visually evident. Sampling equipment, hand tools, etc. will be cleaned with non-phosphorous soap to remove any potentially contaminated soil and rinsed with deionized water. All decontamination fluids will be containerized and stored on-site pending waste characterization sampling and appropriate off-site disposal.

9.2.6 Heavy Equipment Decontamination

All heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the HSO or his designee.

9.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (including equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

9.4 Communications

The following communications equipment will be utilized as appropriate.
• Telephones - A cellular telephone will be located with the HSO for communication with the HSM and emergency support services/facilities.

• Hand Signals - Hand signals must be used by field teams, along with the buddy system. The entire field team must know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

<table>
<thead>
<tr>
<th>Hand Signal</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand gripping throat</td>
<td>Out of air, cannot breathe</td>
</tr>
<tr>
<td>Grip your partner’s wrists or place both hands</td>
<td>Leave immediately without</td>
</tr>
<tr>
<td>around the waist</td>
<td>debate</td>
</tr>
<tr>
<td>Hands on top of head</td>
<td>Need assistance</td>
</tr>
<tr>
<td>Thumbs up</td>
<td>OK; I am all right; I understand</td>
</tr>
<tr>
<td>Thumbs down</td>
<td>No; negative</td>
</tr>
<tr>
<td>Simulated “stick” break with fists</td>
<td>Take a break; stop work</td>
</tr>
</tbody>
</table>

9.5 The Buddy System

When working in teams of two or more, workers will use the “buddy system” for all work activities to ensure that rapid assistance can be provided in the event of an emergency. This requires work groups to be organized such that workers can remain close together and maintain visual contact with one another. Workers using the “buddy system” have the following responsibilities:

• Provide his/her partner with assistance.
• Observe his/her partner for signs of chemical or heat exposure.
• Periodically check the integrity of his/her partner’s PPE.
• Notify the HSO or other site personnel if emergency service is needed.

10.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

NYC Health and Hospitals/Jacobi Medical Center
1400 Pelham Parkway South
Bronx, New York
718-918-5000

A map with directions to the hospital is shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel all of the time. Further, all field personnel, including the HSO & FTL, will know the directions to the hospital.

11.0 STANDING ORDERS/SAFE WORK PRACTICES
The standing orders, which consist of a description of safe work practices that must always be followed while on-site by Langan employees and contractors, are shown in Attachment A. The site HSO and FTL each have the responsibility for enforcing these practices. The standing orders will be posted prominently at the site or are made available to all personnel at all times. Those who do not abide by these safe work practices will be removed from the site.

12.0 SITE SECURITY

No unauthorized personnel must be permitted access to the work areas.

13.0 UNDERGROUND UTILITIES

As provided in Langan’s Underground Utility Clearance Guidelines, the following safe work practices should be followed by Langan personnel and the contractor before and during subsurface work in accordance with federal, state, and local regulations:

- Obtain available utility drawings from the property owner/client or operator.
- Provide utility drawings to the project team.
- In the field, mark the proposed area of subsurface disturbance (when possible).
- Ensure that the utility clearance system has been notified.
- Ensure that utilities are marked before beginning subsurface work.
- Discuss subsurface work locations with the owner/client and contractors.
- Obtain approval from the owner/client and operators for proposed subsurface work locations.
- Use safe digging procedures when applicable.
- Stay at least 10-feet from all equipment performing subsurface work.

14.0 SITE SAFETY INSPECTION

The Langan HSO or alternate will check the work area daily, at the beginning and end of each work shift, or more frequently to ensure safe work conditions. The HSO or alternate must complete the Jobsite Safety Inspection Checklist, found in Attachment F. Any deficiencies must be shared with the FTL, HSM, and PM and will be discussed at the daily tailgate meeting.

15.0 HAND AND POWER TOOLS

All hand- and electric-power tools and similar equipment must be maintained in a safe operating condition. All electric-power tools must be inspected before initial use. Damaged tools must be removed immediately from service or repaired. Tools must be used only for the purpose for which they were designed. All users must be properly trained in their safe operation.
16.0  EMERGENCY RESPONSE

16.1  General

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed in the following subsections include communications, local emergency support units, and preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911, call WorkCare- Incident Intervention® at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at 973-560-4699 as soon as possible.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (Table 5) where a readily accessible telephone is made available for emergency use.

Also, in the event of an incident where a team member becomes exposed or suffers from an acute symptom from contact with site materials and has to be taken to a hospital, a short medical data sheet (Attachment C) for that individual will be made available to the attending physician. The medical data sheet will include the following:

- Name, address, home phone
- Age, height, weight
- Name of person to be notified in case of an accident
- Allergies
- Particular sensitivities
- Does he/she wear contact lenses?
- Short checklist of previous illness
- Name of personal physician and phone
- Name of company physician and phone
- Prescription and non-prescription medications currently used.

An incident reporting form is included in Attachment C.

16.2  Responsibilities

16.2.1  Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely, and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The
HSO is responsible for ensuring the HSM is notified of all incidents, all injuries, near misses, fires, spills, releases, or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time.

### 16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely, and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM is notified of all incidents, all injuries, near misses, fires, spills, releases, or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized).

The Emergency Coordinator must locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator must make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

### 16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. All personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors, will be trained in the Emergency Response Plan.

### 16.3 Communications

Once an emergency situation has been stabilized, or as soon as the injured Langan personnel can be transported should contact WorkCare - Incident Intervention® at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at 973-560-4699 as soon as possible.

### 16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms.
Always contact first responders when there are serious or life-threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements, and treat for shock when necessary.

16.5 Pre-Emergency Planning

Langan will communicate directly with administrative personnel from the emergency room at the hospital to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this HASP are designed to prevent employee injury. However, if an injury occurs, no matter how slight, it will be reported to the HSO immediately. First-aid equipment will be available on-site at the following locations:

- First Aid Kit: Contractor Vehicles
- Emergency Eye Wash: Contractor Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. First-aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

16.7 Personnel with current first aid and CPR certification will be identified.

Only in non-emergency situations may an injured person be transported to an urgent care facility. Due to hazards that may be present at the site and the conditions under which operations are conducted, an emergency may develop. Emergencies can be characterized as injury or acute chemical exposure to personnel, fire or explosion, environmental release, or hazardous weather conditions.

16.8 Emergency Site Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs as a result of the site investigation activities, including but not limited to fire, explosion, or significant release of toxic gas into the atmosphere, the Langan Project Manager will be verbally notified immediately. All heavy equipment will be shut down and all personnel will evacuate the
work areas and assemble at the nearest intersection to be accounted for and to receive further instructions.

If an emergency arises, the FTL will implement an immediate evacuation of all project personnel due to immediate or impending danger. The FTL will also immediately communicate with the contractor to coordinate any needed evacuation of the property.

The FTL or Site Supervisor will give necessary instructions until the Designated Incident Commander (IC) assumes control. After the emergency has been resolved, the FTL or Site Supervisor will coordinate with the IC and indicate when staff should resume their normal duties. If dangers are present for those at the designated assembly point, another designated location of assembly will be established.

It will be the responsibility of the FTL or Site Supervisor to report a fire or emergency, assess the seriousness of the situation, and initiate emergency measures until the arrival of the local fire fighters or other first responders, should they be necessary. The FTL, working with emergency responders, may also order the closure of the Site for an indefinite period as long as it is deemed necessary.

Under no circumstances will incoming visitors be allowed to proceed to the area of concern once an emergency evacuation has been implemented. Visitors or other persons present in the area of the emergency must be instructed to evacuate the area. The FTL will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon the arrival of emergency personnel.

If it is necessary to temporarily control traffic in the event of an emergency, those persons controlling traffic will wear proper reflection warning vests until the arrival of police or fire personnel.

16.8.1 Designated Assembly Locations

All personnel will evacuate the site and assemble at a designated assembly location. The assembly location will be designated by Langan personnel and discussed during each shift’s pre-job safety briefing.

16.8.2 Accounting for Personnel

All contractor and subcontractor supervisors are responsible for the accounting of all personnel assembled at the designed assembly area. The Designated Incident Commander must be notified if personnel are not found.
16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
- Storage of flammable liquids and gases away from oxidizers.
- Shutting off engines to refuel.
- Grounding and bonding metal containers during transfer of flammable liquids.
- Use of UL approved flammable storage cans.
- Fire extinguishers rated at least 10-pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel must evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations must be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator must notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand-wash stations.
**CONTACT:** Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin must also be rinsed for 15 minutes if contact with caustics, acids, or hydrogen peroxide occurs. Affected items of clothing must also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

**16.12 Decontamination during Medical Emergencies**

If emergency lifesaving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, normal decontamination procedures will be followed.

**16.13 Adverse Weather Conditions**

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).
- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.
16.14 Spill Control and Response

All small spills/environmental releases must be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust, or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed of. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles must have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment must be inspected prior to being admitted on-site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps must be taken by the Emergency Coordinator:

1. Determine the nature, identity, and amounts of major spills.
2. Make sure all unnecessary persons are removed from the spill area.
3. Notify the HSO immediately.
4. Use proper PPE in consultation with the HSO.
5. If a flammable liquid, gas, or vapor is involved, remove all ignition sources, and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
6. If possible, try to stop the leak with the appropriate material.
7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this HASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions. Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
• Expected time of cleanup completion. If spill cleanup cannot be handled by Langan’s on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan will not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment must be kept and maintained on site:

• Industrial first aid kit.
• Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies, and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

• Refilling fire extinguishers.
• Refilling medical supplies.
• Recharging eyewashes and/or showers.
• Replenishing spill control supplies.

16.17 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (extension 4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 SPECIAL CONDITIONS

This guideline contains information and requirements for special conditions that may not be routinely encountered.
17.1 Scope

The guideline applies to the specific projects identified within this document. Additional provisions will be addressed in each Site-Specific HEALTH AND SAFETY PLAN (HASP), as needed.

17.2 Responsibilities

Site Personnel - All site personnel must be alert to safety hazards on work sites and take action to minimize such hazards. Personnel must utilize the buddy system, watch for inappropriate behavior, and be alerted to changes in site conditions.

Health and Safety Officer (HSO) - The HSO is responsible for considering these procedures in the development of site-specific HASPs. The HSO must schedule frequent "tail gate" safety briefings to enhance safety awareness and discuss potential problems.

17.3 Procedures

The procedures outlined below must be followed when such conditions are encountered.

17.3.1 Ladders

Langan safety procedures must be used to ensure employee safety when using ladders in the office or work sites. All ladders must be coated or repaired to prevent injury to the employee from punctures or lacerations and to prevent snagging or clothing. Any wood ladders used must have an opaque covering except for identification or warning labels, which may be placed on one face only of a side rail.

17.3.1.1 Ladder Use

Employees must only use ladders for the purposes they were designed for and must not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees must use ladders only on stable and level surfaces unless the ladder is secured to prevent its movement. Ladders should not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Ladders should not be used in locations where they could be displaced by workplace activities or traffic. Ladder rungs, cleats and steps must be parallel, level and uniformly spaced when the ladder is in the use position.

Employees should not be carrying anything including equipment that could cause injury if there was a fall while utilizing the ladder. The top and bottom of the ladder area must remain clear while in use. When ascending and descending the ladder, employees must face the ladder.
Ladders must not be loaded beyond the maximum intended load for which they were built or the manufacturer’s rated capacity.

17.3.1.2 Portable Ladders

Rungs, cleats, and steps for portable ladders and fixed ladders must be spaced not less than 10 inches apart, nor more than 14-inches apart, as measured between center lines of the rungs, cleats, and steps. When used to access an upper landing surface, the ladder side rails must extend at least three feet above the upper landing surface to which the ladder is used to gain access. If this is not possible, due to the length of the ladder, then the top of the ladder must be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats, and steps of step stools must not be less than 8-inches apart, nor more than 12-inches apart, as measured between center lines of the rungs, cleats, and steps.

17.3.1.4 Extension Ladders

Rungs, cleats, and steps of the base section of extension trestle ladders must be spaced not less than 8 inches apart, nor more than 18-inches apart, as measured between center lines of the rungs, cleats, and steps. The rung spacing on the extension section of the extension trestle ladder must not be less than 6 inches nor more than 12-inches, as measured between the center lines of the rungs, cleats and steps. Ladders must be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

17.3.1.5 Inspection

Ladders will be inspected for visible detects periodically, prior to utilization or after any occurrence that could have negatively affected the ladder. Portable ladders with defects including broken or missing rungs, cleats, or steps, broken or split rails, corroded components, or other faulty components must not be used. The ladder will be immediately marked as defective, tagged as “Do Not Use” or blocked from being used and removed from service until repaired.

17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR)

Langan field and office personnel will be encouraged to be trained in First Aid and Cardiopulmonary Resuscitation (CPR). Training will be provided free of charge by Langan to all employees. Employees will receive a training certificate that will be kept on file with the Health & Safety Coordinator (HSC). Training and certification will be provided by a credited provider such as American Red Cross or equivalent.
17.3.2.1 Emergency Procedures

Prior to site work, the Langan employees certified in first aid and CPR will be identified in the site-specific HASP. Langan will endeavor to have at least one employee at a job site trained and able to render first aid and CPR. The site-specific HASP will contain first aid information on both potential chemical and physical hazards. Emergency procedures to be followed in case of injury or illnesses are provided in the HASP. The HASP will include emergency contact information including local police and fire departments, hospital emergency rooms, ambulance services, on-site medical personnel, and physicians. The HASP will also include directions and contact information for the nearest emergency facility in case immediate medical attention is required. The emergency contact information will be conspicuously posted at the worksite. Employees that are injured and require immediate medical attention must call either 911 or the local posted emergency contacts. Employees should use ambulatory services to transport injured workers to the nearest facility for emergency medical care. In areas where 911 is not available, the telephone numbers of physicians, hospitals, or ambulances must be conspicuously posted.

17.3.2.2 First Aid Supplies

First aid supplies are readily available to all Langan employees when required. First aid kits are located in each Langan office. Portable first aid kits are available for employees to use at work sites. First aid kits should consist of items needed to treat employees for potential chemical and physical injuries. At a minimum, first aid kits should contain items to allow basic first aid to be rendered. Where the eyes or body of an employee may be exposed to corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body must be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individually sealed packages of each item. All portable first aid kits must be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees must check first aid kits weekly to ensure used items are replaced.

17.3.3 Hydrogen Sulfide

Langan employees with the potential to be exposed to hydrogen sulfide while at work sites must have training in hydrogen sulfide awareness. The training will include the identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, first aid procedures, and personnel protective equipment. Langan employees could be exposed to hydrogen sulfide while at job sites including petroleum refineries, hazardous waste treatment, storage and disposal facilities, uncontrolled hazardous waste sites, and remediation projects.
17.3.3.1 Characteristics

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs that is soluble in water. Hydrogen sulfide is used to test and make other chemicals. It is also found as a by-product of chemical reactions, such as in sewer treatment. It is a highly flammable gas and a dangerous fire hazard. Poisonous gases are produced in fires including sulfur oxides. Hydrogen sulfide is not listed as a carcinogen.

17.3.3.2 Health Effects

Hydrogen Sulfide can affect employees if inhaled or through contact with skin or eyes. Acute (or short-term) health effects of hydrogen sulfide exposure include irritation of the nose and throat, dizziness, confusion, headache, and trouble sleeping. Inhalation of hydrogen sulfide can irritate the lungs causing coughing and/or shortness of breath. Higher levels of exposure can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic (or long-term) health effects of low levels of exposure to hydrogen sulfide can cause pain and redness of the eyes with blurred vision. Repeated exposure may cause bronchitis with cough, phlegm, and shortness of breath.

17.3.3.3 Protective Clothing and Equipment

Respirators are required for those operations in which employees will be exposed to hydrogen sulfide above OSHA permissible exposure level. The maximum OSHA permissible exposure limit (PEL) for hydrogen sulfide is 20-parts of hydrogen sulfide vapor per million parts of air (20 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 10 ppm for any 10-minute period.

Where employees are exposed to levels up to 100-parts of hydrogen sulfide vapor per million parts of air (100 ppm), the following types of respiratory protection are allowed:

- Any powered, air-purifying respirator with cartridge(s).
- Any air-purifying, full-facepiece respirator (gas mask) with a chin style, front- or back-mounted canister.
- Any supplied air system with escape self-contained breathing apparatus, if applicable; and,
- Any self-contained breathing apparatus with a full facepiece.

Respirators used by employees must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval. Cartridges or canisters must be replaced before the end of their service life, or the end of the shift, whichever
occurs first. Langan employees that have the potential to be exposed to hydrogen sulfide will be trained in the proper use of respirators. Respirator training is discussed under Langan’s Respiratory Protection Program.

Employees with potential exposure to hydrogen sulfide, or when required by the client, will wear a portable hydrogen sulfide gas detector. The detector should have an audible, visual, and vibrating alarm. The detector may also provide detection for carbon monoxide, sulfur dioxide, and oxygen-deficient atmospheres. The hydrogen sulfide monitor will, at a minimum, be calibrated to detect hydrogen sulfide at a level of 20-parts of hydrogen sulfide vapor per million parts of air (20 ppm). Many portable gas detectors will have factory defaults with a low-level alarm at 10 ppm and a high-level alarm at 15 ppm. Langan employees must consult clients to determine if any site-specific threshold levels exist.

If the hydrogen sulfide gas detector sounds and employees are not wearing appropriate respiratory protection, employees must immediately vacate the area and meet at the assigned emergency location. Langan employees may not re-enter the site without proper respiratory protection and approval from the client or property owner if needed.

Employees must wear PPE to prevent eye and skin contact with hydrogen sulfide. Employees must wear appropriate protective clothing including boots, gloves, sleeves, and aprons, over any parts of their body that could be exposed to hydrogen sulfide. Non-vented, impact-resistant goggles should be worn when working with or exposed to hydrogen sulfide.

17.3.3.4 Emergency and First Aid Procedures

Eye and Face Exposure

If hydrogen sulfide comes in contact with eyes, it should be washed out immediately with large amounts of water for 30 minutes, occasionally lifting the lower and upper eye lids. Seek medical attention immediately.

Skin Exposure

If hydrogen sulfide contaminates clothing or skin, remove the contaminated clothing immediately and wash the exposed skin with large amounts of water and soap. Seek medical attention immediately. Contaminated clothing should either be disposed of or washed before wearing again.
**Breathing**

If a Langan employee or other personnel breathe in hydrogen sulfide, immediately get the exposed person to fresh air. If breathing has stopped, artificial respiration should be started. Call for medical assistance or a doctor as soon as possible.

**Safety Precautions**

Hydrogen sulfide is a highly flammable gas and a dangerous fire hazard. Containers of hydrogen sulfide may explode in a fire situation. Poisonous gases are produced during fires.

Langan employees should contact property owners and operators prior to conducting work onsite to be aware of any site-specific contingency plans, identify where hydrogen sulfide is used at the facility, and be informed about additional safety rules or procedures.

**17.3.4 Fire Protection/Extinguishers**

Langan field personnel that have been provided with portable fire extinguishers for use at worksites will be trained to familiarize employees with general principles of fire extinguisher use and hazards associated with the incipient stage of firefighting. Training will be provided prior to the initial assignment for field work and annually thereafter.

Portable fire extinguishers must be visually inspected monthly and subjected to an annual maintenance check. Langan will retain records of the annual maintenance date.

**17.3.5 Overhead lines**

When field work is performed near overhead lines, the lines must be de-energized and grounded, or other protective measures must be provided before the work commences. If overhead lines are to be de-energized, arrangements must be made with the client, property owner, or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions must prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When unqualified Langan personnel are working in an elevated position near overhead lines, the location must be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

1. For voltages to ground 50-kilovolts (kV) or below - 10-feet; and
2. For voltages to ground over 50kV - 10-feet, plus 4-inches for every 10kV over 50kV.
As previously indicated, Langan does not retain qualified employees to perform work on energized equipment.

**17.3.5.1 Vehicle and Equipment Clearance**

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines must be operated so that a clearance of 10-feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance must be increased by 4-inches for every 10kV over that voltage.

If any of the following discussed conditions occur, the clearance may be reduced.

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4-ft. If the voltage is higher than 50kV, the clearance must be increased to 4-inches for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments unless the employee is using protective equipment rated for the voltage, or the equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the overhead line than permitted.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, must be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

**17.3.6 Trade Secret**

Langan employees could potentially be provided trade secret information by the client or property owner when site-specific information is provided about highly hazardous chemicals. Trade secret means any confidential formula, pattern, process, device, information, or compilation of information that is used in an employer’s business, and that allows the employer to obtain an advantage over competitors who do not know or use it. Langan employees understand that this
information should be kept confidential and if required, may enter into a confidentiality agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can anticipate exposure to blood or other potentially infectious material while at work sites must have training in bloodborne pathogens. Applicable employees would include those trained in first aid and serving a designated role as an emergency medical care provider. Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include but are not limited to, hepatitis B virus and human immunodeficiency virus.

17.3.7.1 Training

Langan employees with potential occupational exposure to blood or other potentially infectious material must participate in a training program. Training must be conducted prior to the initial assignment where there would be potential for exposure and annually thereafter within one year of previous training. The training program will be provided to Langan employees at no cost to them and during working hours.

Langan will ensure the training program must consist of the following:

- A general explanation of the epidemiology and symptoms of bloodborne diseases.
- An explanation of the modes of transmission of bloodborne pathogens.
- An explanation of Langan’s exposure control plan and how the employee can obtain a copy of the written plan.
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials.
- An explanation of the use and limitations of personal protective equipment (PPE) to prevent and reduce exposure.
- Information on the types, proper use, location, removal, handling, and disposal of PPE.
- An explanation of the basis for the selection of PPE.
- Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge.
- Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials.
- An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available.
• Information on the post-exposure evaluation and determining whether the employer is required to provide for the employee following an exposure incident.

• An explanation of the signs and labels and/or color coding required by paragraph 29 CFR 1910.1030(g)(1); and

• An opportunity for interactive questions and answers with the person conducting the training session.

Langan will develop and implement a written Exposure Control Plan, which will be designed to eliminate or minimize employee exposure to bloodborne pathogens. The Exposure Control Plan will contain the following elements:

• An exposure determination for employees.

• The schedule and method of implementation for Methods of Compliance (29 CFR 1910.1030(d)), Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up (29 CFR 1910.1030(f)), Communication of Hazards to Employees (29 CFR 1910.1030(g)) and (h) Recordkeeping (29 CFR 1910.1030(h)).

• The procedure for the evaluation of circumstances surrounding exposure incidents.

• Ensure a copy of the Exposure Control Plan will be accessible to employees; and,

• The Exposure Control Plan must be reviewed and updated at least annually.

Langan employees with occupational exposure to bloodborne pathogens include any employees trained in first aid that would be expected to provide emergency medical care. This determination is made without regard to the use of PPE, which could eliminate or minimize exposure.

Universal precautions must be observed to prevent contact with blood or other potentially infectious materials. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for bloodborne pathogens. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids must be considered potentially infectious materials.

Work practice controls must be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during the rendering of first aid, personnel protective equipment will be utilized to reduce or minimize exposure. PPE that could be available to Langan personnel when administering first aid includes safety glasses, gloves, and Tyvek suits or sleeves. PPE and first aid kits will be provided to employees at no cost to them.

Langan employees that render first aid in office areas will have access to hand-washing facilities or restrooms. For first aid rendered at field locations, first aid kits will contain an appropriate antiseptic hand cleanser and clean cloth/paper towels or antiseptic towelettes. After using
antiseptic hand cleansers or towelettes, employees must wash their hands with soap and running water as soon as feasible.

After administering first aid, potentially infectious materials, including towels, personnel protective equipment, clothes, and bandages, must be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be disposed of after use. Any equipment or working surfaces which was been exposed to blood or potentially infectious materials due to an injury will be decontaminated prior to reuse.

Langan will make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. These services will be available to the employee at no cost to them through a medical provider.

17.3.7.2 Recordkeeping

Langan will maintain training and medical records for each employee with occupational exposure to blood or potentially infectious materials. Medical and training records will be maintained by Langan’s H&S Department.

Training records will include the following:

- Dates of the training sessions.
- Contents or a summary of the training sessions.
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training sessions.

Training records must be maintained for 3 years from the date on which the training occurred. Medical records will be preserved and maintained for the duration of employment plus 30 years.

All records will be made available upon request to employees, the Assistant Secretary of Labor for Occupational Safety and Health, and the Director of the National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from the employee before releasing.

If Langan ceases to do business, all records must be transferred to the successor employer. The successor employer must receive and maintain these records.

If there will not be a successor, Langan will notify current employees of their rights to access records at least three months prior to the cessation of business.
18.0 RECORDKEEPING

The following is a summary of required health and safety logs, reports, and recordkeeping.

18.1 Field Change Authorization Request

Any changes to the work to be performed that are not included in the HASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared. Approved changes will be reviewed with all field personnel at a safety briefing.

18.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day on-the-job training (OJT)), and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records will be maintained by the HSM.

18.3 Onsite Log

A log of personnel on-site each day will be kept by the HSO or designee.

18.4 Daily Safety Meetings (“Tailgate Talks”)

Completed safety briefing forms will be maintained by the HSO.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At the end of the project, they will be maintained according to 29 CFR 1910.1020.

18.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this HASP (Attachment D). Langan’s written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

18.7 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan incident/injury hotline at 1-800-952-6426, extension 4699, and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and
submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, the employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident. Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.7.1 Accident and Injury Report Forms

18.7.1.1 Accident/Incident Report

All injuries, no matter how slight, must be reported to the FTL and the PM immediately. The accident/incident report forms, attached in Attachment C, will be filled out on all accidents by the applicable contractor supervision personnel, the FTL, or the HSO. Copies of all accident/incident reports must be kept on-site and available for review. Project personnel will be instructed on the location of the first aid station, hospital, and doctor and ambulance service near the job. The emergency telephone numbers will be conspicuously posted in site vehicles near the work zone. First aid supplies will be centrally located and conspicuously posted between restricted and nonrestricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The forms will be used for recording all non-lost time injuries treated by the project first-aid attendant, the local physician or hospital will be entered in detail on this record. “Minor” treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

18.7.1.3 OSHA Form 300

An OSHA Form 300 will be kept at the Langan Corporate Office in Parsippany, New Jersey. All recordable injuries or illnesses will be recorded on this form. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form. The Incident Report form used to capture the details of work-related injuries/illnesses meets the requirements of the OSHA Form 301 (supplemental record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses. Forms for recording OSHA work-related injuries and illnesses are included in Attachment C.

19.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the Site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that all
applicable federal, state, and local regulations. Confined spaces **will not** be entered by Langan personnel.

### 20.0 HASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this HASP Compliance Agreement indicating that they have become familiar with this HASP and that they understand it and agree to abide by it.
# TABLE 1
## TASK HAZARD ANALYSES

<table>
<thead>
<tr>
<th>Task</th>
<th>Hazard</th>
<th>Description</th>
<th>Control Measures</th>
<th>First Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Contaminated Soil or Groundwater-Dermal Contact</td>
<td>Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.</td>
<td>Wear proper PPE; follow safe practices, maintain safe distance from construction activities</td>
<td>See Table 2, seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Lacerations, abrasions, punctures</td>
<td>Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces</td>
<td>Wear proper PPE; follow safe practices</td>
<td>Clean wound, apply pressure and/or bandages; seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Contaminated Media Inhalation</td>
<td>Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation</td>
<td>Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities</td>
<td>See Table 2, seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Lifting</td>
<td>Improper lifting/carrying of equipment and materials causing strains</td>
<td>Follow safe lifting techniques. Langan employees are not to carry contractor equipment or materials</td>
<td>Rest, ice, compression, elevation; seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Slips, trips, and falls</td>
<td>Slips, trips, and falls due to uneven surfaces, cords, steep slopes, debris, and equipment in work areas</td>
<td>Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus</td>
<td>Rest, ice, compression, elevation; seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Noise</td>
<td>Excavation equipment, hand tools, drilling equipment.</td>
<td>Wear hearing protection; maintain safe distance from construction activities</td>
<td>Seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Falling objects</td>
<td>Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.</td>
<td>Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations</td>
<td>Seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Underground/overhead utilities</td>
<td>Excavation equipment, drill rig auger contacts underground object; boom touches overhead utility</td>
<td>&quot;One Call&quot; before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations</td>
<td>Seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Insects (bees, wasps, hornet, mosquitoes, and spider)</td>
<td>Sings, bites</td>
<td>Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants); field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on site</td>
<td>Seek medical attention as required</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Vehicle traffic / Heavy Equipment Operation</td>
<td>Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms</td>
<td>Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment</td>
<td>Seek medical attention as required</td>
</tr>
</tbody>
</table>
# TABLE 2
## CONTAMINANT HAZARDS OF CONCERN

<table>
<thead>
<tr>
<th>Task</th>
<th>Contaminant</th>
<th>CAS Number</th>
<th>Monitoring Device</th>
<th>PEL/IDLH</th>
<th>Source of Concentration on Site</th>
<th>Route of Exposure</th>
<th>Symptoms</th>
<th>First Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,1'-Biphenyl 1,1-Biphenyl Biphenyl Phenyl benzene Diphenyl</td>
<td>92-52-4</td>
<td>None</td>
<td>None</td>
<td>Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage</td>
<td>Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,2,4,5-Tetramethylbenzene Durene</td>
<td>95-93-2</td>
<td>NA</td>
<td>None</td>
<td>Groundwater Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)</td>
<td>Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,2,4-Trimethylbenzene</td>
<td>95-63-6</td>
<td>PID</td>
<td>None</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)</td>
<td>Eye: Irrigate immediately Skin: Soap wash breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
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</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>PID</td>
<td>50 ppm 200 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eye, swelling peri-orbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene</td>
<td>108-67-8</td>
<td>PID</td>
<td>None</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustions), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)</td>
<td>Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene</td>
<td>106-99-0</td>
<td>PID</td>
<td>1 ppm 2000 ppm</td>
<td>Vapor</td>
<td>inhalation, skin, and/or eye contact (liquid)</td>
<td>irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]</td>
<td>Eye: Frostbite Skin: Frostbite Breathing: Respiratory support</td>
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<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
<td>Monitoring Device</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>2,2,4-Trimethylpentane</td>
<td>540-84-1</td>
<td>PID</td>
<td>NA</td>
<td>Groundwater</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)</td>
<td>Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Isooctane</td>
<td></td>
<td></td>
<td>NA</td>
<td>Soil, Vapor</td>
<td></td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>2,4-Dimethylphenol</td>
<td>105-67-9</td>
<td>None</td>
<td>NA</td>
<td>Groundwater</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage</td>
<td>Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>2,4-Xylenol</td>
<td></td>
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<td>Groundwater</td>
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<td>1.3.1 – 1.3.13</td>
<td>1-Hydroxy-2,4-</td>
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<td>1.3.1 – 1.3.13</td>
<td>dimethylbenzene</td>
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<td>1.3.1 – 1.3.13</td>
<td>2,4-Dimethylphenol</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>4-Hydroxy-1,3-</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>dimethylbenzene</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>4,6-Dimethylphenol</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>1,3-Dimethyl-4-hydroxybenzene</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>2-Butanone</td>
<td>78-93-3</td>
<td>PID</td>
<td>200 ppm</td>
<td>Soil, Groundwater</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis</td>
<td>Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Ethyl methyl ketone</td>
<td></td>
<td></td>
<td>3000 ppm</td>
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<td>1.3.1 – 1.3.13</td>
<td>MEK</td>
<td></td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Methyl acetone</td>
<td></td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Methyl ethyl ketone</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>2-Hexanone</td>
<td>591-78-6</td>
<td>PID</td>
<td>100 ppm</td>
<td>Groundwater</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
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</table>
| 1.3.1 – 1.3.13 | 2-Methylnaphthalene, \( \beta \)-methylnaphthalene                           | 91-57-6    | PID              | NA      | Groundwater, Soil, Vapor        | inhalation, ingestion or skin, absorption, eye contact | irritation to the skin, eyes, mucous membranes, and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and coma | Eye: Irrigate immediately  
Skin: Water flush promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | 4,4’-DDD (Dichlorodiphenylchloroethane) 1,1’-(2,2-Dichloroethylidene)bis (4-chlorobenzene) p,p’-DDD | 72-54-8    | None             | NA      | Groundwater, Soil               | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis; vomiting; [potential occupational carcinogen] | Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | 4-Isopropyltoluene; 1-Methyl-4-(1-methylethyl)benzene  
4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene  
Dolcymene  
Camphogen  
Paracycmenne  
Cymene  
p-Cymene  
p-Isopropyltoluene | 99-87-6    | PID              | NA      | Soil, Groundwater, Vapor        | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma | Eye: Irrigate immediately  
Skin: Water flush promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
<table>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Acenaphthene, 1,2-Dihydroacenaphthylene, 1,8-Ethylidenenaphthalene, peri-Ethylidenenaphthalene, Naphthyleneethylen, Tricyclododecanapentaene</td>
<td>83-32-9</td>
<td>PID</td>
<td>NA</td>
<td>Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the skin, eyes, mucous membranes, and upper respiratory tract; If ingested, it can cause vomiting</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately. Breathing: Move to fresh air. Swallow: do not induce vomiting, seek medical attention immediately.</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Acenaphthylene, Cycopental(de)naphthalene, Acenaphthalene</td>
<td>208-96-8</td>
<td>PID</td>
<td>NA</td>
<td>Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the skin, eyes, mucous membranes, and upper respiratory tract</td>
<td>Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately. Breathing: Move to fresh air. Swallow: do not induce vomiting, seek medical attention immediately.</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Acetone Dimethyl ketone Ketone propane 2-Propanone</td>
<td>67-64-1</td>
<td>PID</td>
<td>1000 ppm 2500 ppm</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Aluminum</td>
<td>7429-90-5</td>
<td>None</td>
<td>0.5 mg/m³ 50 mg/m³</td>
<td>Soil</td>
<td>inhalation, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, respiratory system</td>
<td>Eye: Irrigate immediately Breathing: Fresh air</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Anthracene</td>
<td>120-12-7</td>
<td>PID</td>
<td>0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)</td>
<td>Soil</td>
<td>inhalation, skin, or eye contact, ingestion</td>
<td>irritation to the skin, eyes, mucous membranes, and upper respiratory tract, abdominal pain if ingested.</td>
<td>Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention. Swallow: refer to medical attention.</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Antimony</td>
<td>7440-36-0</td>
<td>None</td>
<td>0.5 mg/m³ 50 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation skin, dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td>Task</td>
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<td>First Aid</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Aroclor 1260</td>
<td>11096-82-5</td>
<td>None</td>
<td>0.5 mg/m³</td>
<td>Groundwater, Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, chloracne</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Aroclor 1268</td>
<td>11100-14-4</td>
<td>None</td>
<td>0.5 mg/m³</td>
<td>Groundwater, Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, chloracne</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Arsenic</td>
<td>NA</td>
<td>None</td>
<td>0.5 mg/m³</td>
<td>Groundwater, Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation skin, dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Barium</td>
<td>10022-31-8</td>
<td>None</td>
<td>0.5 mg/m³</td>
<td>Groundwater, Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, upper respiratory system; skin, burns; gastroenteritis; muscle spasm; slow pulse</td>
<td>Eye: Irrigate immediately, Skin: Water flush immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
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<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
<td>Monitoring Device</td>
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<td>1.3.1 – 1.3.13</td>
<td>Benzene Benzol Phenyl hydride Alkyl benzene isomers</td>
<td>71-43-2</td>
<td>PID</td>
<td>3.19 mg/m³ 1.595 mg/m³</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Benzo(a)anthracene Benzoanthracene Benzanthrene 1,2-Benzoanthracene Benzo(b)phenanthrene Tetraphene</td>
<td>56-55-3</td>
<td>PID</td>
<td>0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)</td>
<td>Groundwater Soil</td>
<td>inhalation, skin, or eye contact, ingestion</td>
<td>dermatitis, bronchitis, [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Benzo(a)pyrene</td>
<td>50-32-8</td>
<td>PID</td>
<td>0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)</td>
<td>Soil</td>
<td>inhalation, skin, or eye contact, ingestion</td>
<td>dermatitis, bronchitis, [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Induce vomiting if conscious, seek medical attention immediately</td>
</tr>
<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
<td>Monitoring Device</td>
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<td>Source of Concentration on Site</td>
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</table>
| 1.3.1 – 1.3.13 | Benzo(b)fluoranthene             | 205-99-2   | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Soil              | inhalation, skin, or eye contact, ingestion                            | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Benzo(g,h,i)perylene  
Benzo(ghi)perylene | 191-24-2   | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Soil              | inhalation, skin, or eye contact, ingestion                            | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Benzo(k)fluoranthene             | 207-08-9   | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Soil              | inhalation, skin, or eye contact, ingestion                            | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Benzoic acid  
Carboxybenzene  
E210  
Dracrylic acid  
Phenylmethanoic acid  
Benzenecarboxylic acid  
Benzoic acid isomer | 65-85-0    | None              | NA NA                | Groundwater Soil Vapor     | inhalation, skin, or eye contact, ingestion                            | irritation to eyes with eye damage, skin, causing rash, redness or burning, irritation to nose, throat, and lungs | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air |
<table>
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<tr>
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<th>Contaminant</th>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Beryllium</td>
<td>7440-41-7</td>
<td>None</td>
<td>0.002 mg/m³ 4 mg/m³</td>
<td>Soil</td>
<td>inhalation, skin, and/or eye contact</td>
<td>berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Breathing: Fresh air</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Beta BHC Beta Hexachlorocyclohexane 1-alpha,2-beta,3-alpha,4-beta,5-alpha,6-beta-Hexachlorocyclohexane beta-1,2,3,4,5,6-Hexachlorocyclohexane Beta-BHC</td>
<td>319-85-7</td>
<td>None</td>
<td>NA</td>
<td>NA</td>
<td>Soil</td>
<td>irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>BTEX Benzene, Toluene, Ethylbenzene M-Xylene, O-Xylene And P-Xylene; BTEX I; BTEX II; BTEX Mixture I; BTEX Mixture II; BTEX Stock Standard Total BTEX</td>
<td>PID</td>
<td>3.19 mg/m³ 1,595 mg/m³</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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| 1.3.1 – 1.3.13 | Cadmium                                   | 7440-43-9  | None              | 0.005 mg/m³, 9 mg/m³ | Soil            | inhalation, ingestion                  | pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen] | Eye: Irrigate immediately  
Skin: Soap wash  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Calcium                                   | 7440-70-2  | None              | NA             | Groundwater, Soil             | inhalation, ingestion, skin, and/or eye contact | irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis | Eye: Irrigate immediately  
Skin: Water flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Carbazole, 9-azafluorene, Dibenzopyrrole, Diphenylenimine, diphenyleneimide | 86-74-8    | None              | NA             | Soil            | inhalation, skin absorption (liquid), skin, and/or eye contact | irritation to eyes and skin, respiratory irritation | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
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<tr>
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<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Carbon disulfide</td>
<td>75-15-0</td>
<td>PID</td>
<td>20 ppm</td>
<td>Soil</td>
<td>inhalation, skin, or eye contact, ingestion</td>
<td>irritation to the eyes, skin, respiratory system</td>
<td>Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support</td>
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<td></td>
<td>500 ppm</td>
<td>Groundwater</td>
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<td></td>
<td>Vapor</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Chromium Total Chromium Chromium, Total</td>
<td>7440-47-3</td>
<td>None</td>
<td>1.0 mg/m³</td>
<td>Groundwater</td>
<td>inhalation absorption ingestion</td>
<td>irritation to eye, skin, and respiratory</td>
<td>Eye: Irrigate immediately (liquid) Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td></td>
<td>250 mg/m³</td>
<td>Soil</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene</td>
<td>218-01-9</td>
<td>PID</td>
<td>0.2 mg/m³</td>
<td>Groundwater</td>
<td>inhalation, absorption, ingestion, consumption</td>
<td>irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]</td>
<td>Eyes: Irrigate immediately (liquid) Skin: Soap wash promptly. Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td>80 mg/m³</td>
<td>Soil</td>
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<td></td>
<td>Coal Pitch Tar</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Cobalt</td>
<td>7440-48-4</td>
<td>None</td>
<td>0.1 mg/m³</td>
<td>Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma</td>
<td>Eye: Irrigate immediately (liquid) Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td></td>
<td>20 mg/m³</td>
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<tr>
<td>1.3.1–1.3.13</td>
<td>Copper</td>
<td>7440-50-8</td>
<td>None</td>
<td>1.0 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, nose, metallic taste; dermatitis; anemia</td>
<td>Eye: Irrigate immediately&lt;br&gt;Skin: Soap wash promptly&lt;br&gt;Breathing: Respiratory support&lt;br&gt;Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1–1.3.13</td>
<td>Cumene Cumol Isopropylbenzene 2-Phenyl propane 1-methylethylbenzene Isopropyl Benzene</td>
<td>98-82-8</td>
<td>PID</td>
<td>50 ppm 900 ppm</td>
<td>Groundwater Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma</td>
<td>Eye: Irrigate immediately&lt;br&gt;Skin: Water flush promptly&lt;br&gt;Breathing: Respiratory support&lt;br&gt;Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1–1.3.13</td>
<td>Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene</td>
<td>110-82-7</td>
<td>PID</td>
<td>300 ppm 1300 ppm</td>
<td>Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma</td>
<td>Eye: Irrigate immediately&lt;br&gt;Skin: Water flush promptly&lt;br&gt;Breathing: Respiratory support&lt;br&gt;Swallow: Medical attention immediately</td>
</tr>
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| 1.3.1 – 1.3.13 | DDE 4,4-DDE 4,4’-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Diclorodiphenyldichloroethylene p,p’-DDE | 72-55-9    | None              | NA NA    | Soil                            | Inhalation, skin absorption, ingestion, skin, and/or eye contact | Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling, sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4’ DDE may cross the placenta and can be excreted in breast milk | Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Dibenz[a,h]anthracene Dibenzo(a,h)anthracene Dibenzo[a,h]anthracene | 53-70-3    | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Groundwater Soil | Inhalation, absorption, ingestion, consumption | Irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen] | Eyes: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
PID Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Dibenzofuran                                                               | 132-64-9   | None              | NA NA    | Soil                            | Inhalation, absorption               | Irritation to eyes, and skin | Eyes: Irrigate immediately  
Skin: Soap wash promptly |
| 1.3.1 – 1.3.13 | Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12 Freon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12 Dichlorodifluoromethane | 75-71-8    | None              | 1000 pp, 15,000 ppm | Groundwater Soil Vapor | Inhalation, skin, and/or eye contact (liquid) | Dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite | Eye: Frostbite  
Skin: Frostbite  
Breathing: Respiratory support |
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel</td>
<td>68334-30-5</td>
<td>PID</td>
<td>NA</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)</td>
<td>Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Diethyl phthalate DEP Diethyl ester of phthalic acid Ethyl phthalate Diethylphthalate</td>
<td>84-66-2</td>
<td>PID</td>
<td>NA</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); polyneuropathy, vestibular dysfunction; pain, numb, lassitude (weakness, exhaustion), spasms in arms &amp; legs; In Animals: reproductive effects</td>
<td>Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Endosulfan sulfate 1,4,5,6,7-Hexachloro-5-norbornene-2,3-dimethanol, cyclic sulfate 6,7,8,9,10,10-hexachloro01,5,5a,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide</td>
<td>1031-07-8</td>
<td>None</td>
<td>NA</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>Hypersensitive to stimulation, sensation of pricking, tingling, or creeping on skin. Headache, dizziness, nausea, vomiting, incoordination, tremor, mental confusion, hyperexcitable state. In severe cases: convulsions, seizures, coma, and respiratory depression.</td>
<td>Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td>1.3.1 – 1.3.13</td>
<td>Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethyl alcohol ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol</td>
<td>64-17-5</td>
<td>PID</td>
<td>1000 ppm 3300 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects</td>
<td>Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane</td>
<td>100-41-4</td>
<td>PID</td>
<td>435 mg/m³ 3,472 mg/m³</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma</td>
<td>Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Fluorantheine Benzol,kjfluorene</td>
<td>206-44-0</td>
<td>PID</td>
<td>0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)</td>
<td>Groundwater Soil</td>
<td>inhalation, skin, or eye contact, ingestion</td>
<td>irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)</td>
<td>Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately</td>
</tr>
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<td>Task</td>
<td>Contaminant</td>
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| 1.3.1 – 1.3.13 | Fluorene         | 86-73-7    | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Soil                 | inhalation, skin, or eye contact, ingestion | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention |
| 1.3.1 – 1.3.13 | Fuel Oil No. 2   | 68476-30-2 | PID               | NA       | Groundwater, Soil, Vapor       | inhalation, ingestion, skin, and/or eye contact | irritation to the eyes, skin, nose, throat; burning sensation in chest; headache; nausea; lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid) | Eye: Irrigate immediately  
Skin: Soap flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Gasoline         | 8006-61-9  | PID               | NA       | Groundwater, Soil, Vapor       | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid) | Eye: Irrigate immediately  
Skin: Soap flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
<p>| 1.3.1 – 1.3.13 | Helium           | 7440-59-7  | Helium Detector   | NA       | NA                             | inhalation         | dizziness, headache, and nausea                                                                                   | Breathing: Respiratory support |
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</table>
| 1.3.1 – 1.3.13 | Heptane n-Heptane                                                           | 142-82-5   | PID               | 500 ppm 750 ppm | Groundwater Soil Vapor         | inhalation, ingestion, skin, and/or eye contact      | dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness | Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Hexachlorobenzene  
Perchlorobenzene  
Pentachlorophenylchloride  
Benzene hexachloride  
Phenyl perchloryl  
HCB  
BHC | 118-74-1   | NA                  | NA NA          | Groundwater Soil | inhalation, ingestion, skin, and/or eye contact | Irritating to eyes, skin, and mucous membranes. Prolonged periods of ingestion may cause cutaneous porphyria | Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Indeno[1,2,3-cd]pyrene  
Indeno[1,2,3-cd]Pyrene  
Indeno[1,2,3-cd]Pyrene | 193-39-5   | None              | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Groundwater Soil | inhalation, absorption, ingestion, consumption | Irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen] | Eyes: Irrigate immediately  
Skin: Soap wash promptly.  
Breath: Respiratory support  
Swallow: Medical attention immediately, wash mouth with water |
| 1.3.1 – 1.3.13 | Iron                                                                     | 7439-89-6  | None              | 10 mg/m³ NA   | Groundwater Soil               | inhalation, ingestion, skin, and/or eye contact      | Irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting | Eye: Irrigate immediately  
Skin: Soap wash  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
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<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol Isopropylalcohol</td>
<td>67-63-0</td>
<td>PID</td>
<td>400 ppm 2000 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis</td>
<td>Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Lead</td>
<td>7439-92-1</td>
<td>None</td>
<td>0.050 mg/m³ 100 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension</td>
<td>Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Magnesium</td>
<td>7439-95-4</td>
<td>None</td>
<td>15 mg/m³ NA</td>
<td>Soil</td>
<td>inhalation, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, respiratory system; cough</td>
<td>Eye: Irrigate immediately Breathing: Fresh air</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Manganese</td>
<td>7439-96-5</td>
<td>None</td>
<td>5 mg/m³ 500 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation, ingestion</td>
<td>aerosol is irritating to the respiratory tract</td>
<td>Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>m-Cresol, meta-Cresol, 3-Cresol, m-Cresylic acid, 1-Hydroxy-3-methylbenzene, 3-Hydroxytoluene, 3-Methylphenol, 3-Methylphenols</td>
<td>108-39-4</td>
<td>PID</td>
<td>5 ppm 250 ppm</td>
<td>Groundwater, Soil, Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin, burns; dermatitis; lung, liver, kidney, pancreas damage</td>
<td>Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Mercury</td>
<td>7439-97-6</td>
<td>None</td>
<td>0.1 mg/m³ 10 mg/m³</td>
<td>Groundwater, Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria</td>
<td>Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Methyl Chloride, Chloromethane, Monochloromethane, Refrigerant-40 R-40</td>
<td>74-87-3</td>
<td>NA</td>
<td>100 ppm 2000 ppm</td>
<td>Groundwater, Soil</td>
<td>inhalation, skin, and/or eye contact</td>
<td>dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]</td>
<td>Eye: Frostbite Skin: Frostbite Breathing: Respiratory support</td>
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<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
<td>Monitoring Device</td>
<td>PEL/IDLH</td>
<td>Source of Concentration on Site</td>
<td>Route of Exposure</td>
<td>Symptoms</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Methyl tert-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe Methyl tert butyl ether</td>
<td>1634-04-4</td>
<td>PID</td>
<td>NA</td>
<td>NA</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid) Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Methylene Chloride Dichloromethane Methylene dichloride</td>
<td>75-09-2</td>
<td>PID</td>
<td>25 ppm 2300 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen] Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
<td></td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene</td>
<td>108-38-3 179601-23-1</td>
<td>PID</td>
<td>100 ppm 900 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<tr>
<td>Task</td>
<td>Contaminant</td>
<td>CAS Number</td>
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<tr>
<td>1.3.1 – 1.3.13</td>
<td>Naphthalene Naphthalin Tar camphor White tar</td>
<td>91-20-3</td>
<td>PID</td>
<td>50 mg/m³ 250 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis</td>
<td>Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>n-Butylbenzene Butylbenzene 1-phenylbutane</td>
<td>104-51-8</td>
<td>PID</td>
<td>NA NA</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury</td>
<td>Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Nickel</td>
<td>7440-02-0</td>
<td>None</td>
<td>NA 10 mg/m³</td>
<td>Groundwater Soil</td>
<td>ion, ingestion, skin, and/or eye contact</td>
<td>sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]</td>
<td>Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Task</td>
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<td>1.3.1 – 1.3.13</td>
<td>Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas: Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen)</td>
<td>7782-44-7 74-82-8 7783-08-4 830-08-0 7727-37-9</td>
<td>Multi-Gas PID</td>
<td>NA/NA</td>
<td>NA</td>
<td>NA</td>
<td>inhalation</td>
<td>dizziness, headache, and nausea</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas: Oxygen Isobutylene Nitrogen)</td>
<td>7782-44-7 115-11-7 7727-37-9</td>
<td>PID</td>
<td>NA/NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>inhalation</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane Propylbenzene-n</td>
<td>103-65-1</td>
<td>Groundwater Soil Vapor</td>
<td>PID</td>
<td>NA NA NA</td>
<td>100 ppm 900 ppm</td>
<td>Soil Vapor</td>
<td>ingestion, skin contact</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol</td>
<td>95-47-6 179601-23-1</td>
<td>Soil Vapor</td>
<td>PID</td>
<td>100 ppm 900 ppm</td>
<td></td>
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<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
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<td>1.3.1 – 1.3.13</td>
<td>p-Cresol, para-Cresol, 4-Cresol, p-Cresylic acid, 1-Hydroxy-4-methylbenzene, 4-Hydroxytoluene, 4-Methylphenol, 4-Methylphenols</td>
<td>106-44-5</td>
<td>PID</td>
<td>5 ppm 250 ppm</td>
<td>Groundwater, Soil, Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin, burns; dermatitis; lung, liver, kidney, pancreas damage</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>p-Diethylbenzene, 1,4-Diethylbenzene, 1,4-Diethyl benzene</td>
<td>105-05-5</td>
<td>PID</td>
<td>None</td>
<td>Groundwater, Soil, Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, respiratory system; skin, burns; in animals: central nervous system depression</td>
<td>Eye: Irrigate immediately, Skin: Soap wash immediately, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>p-Ethyltoluene, 4-Ethyltoluene, 1-ethyl-4-methyl-benzene, 1-methyl-4-ethylbenzene</td>
<td>622-96-8</td>
<td>NA</td>
<td>NA</td>
<td>Soil</td>
<td>ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma</td>
<td>Eye: Irrigate immediately, Skin: Water flush promptly, Breathing: Respiratory support, Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>Task</td>
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<td>Monitoring Device</td>
<td>PEL/ IDLH</td>
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</table>
| 1.3.1 – 1.3.13 | Phenanthrene                                                               | 85-01-8    | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Groundwater Soil                | inhalation, skin, or eye contact, ingestion | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Phenol  
Carbolic acid  
Hydroxybenzene,  
Monohydroxybenzene  
Phenyl alcohol  
Phenyl hydroxide | 108-95-2   | PID               | 5 ppm 250 ppm     | Groundwater Soil                | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine, skin, burns; dermatitis; tremor, convulsions, twitching | Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
<table>
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<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Potassium</td>
<td>7440-09-7</td>
<td>None</td>
<td>NA NA</td>
<td>Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>eye: Causes eye burns. Skin: Causes skin, burns. Reacts with moisture in the skin, to form potassium hydroxide and hydrogen with heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal because of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema.</td>
<td>Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with water for at least 15 minutes while removing contaminated clothing and shoes. Ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>p-Xylenes</td>
<td>106-42-3</td>
<td>PID</td>
<td>100 ppm 900 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis</td>
<td>Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately</td>
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<td></td>
<td>1,4-Dimethylbenzene</td>
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<td></td>
<td>para-Xylene</td>
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<tr>
<td></td>
<td>p-Xylol</td>
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</table>
| 1.3.1 – 1.3.13 | Pyrene benzo(def)phenanthrene  | 129-00-0   | PID               | 0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar) | Groundwater Soil | inhalation, skin, or eye contact, ingestion | irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache) | Eye: Irrigate immediately, refer to medical attention  
Skin: Soap wash immediately  
Breathing: move to fresh air  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | sec-Butylbenzene 2-phenylbutane | 135-98-8   | PID               | 10 ppm 100 ppm | Groundwater Soil | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, nose, throat. Inhalation: nausea or vomiting | Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Selenium                        | 7782-49-2  | None              | 1 mg/m³ 0.2 mg/m³ | Soil               | inhalation, ingestion, skin, and/or eye contact | irritation to the eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin, burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage | Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
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<tbody>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Sodium</td>
<td>7440-23-5</td>
<td>None</td>
<td>NA</td>
<td>NA</td>
<td>Groundwater Soil</td>
<td>ion, ingestion, skin, and/or eye contact</td>
<td>sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol Tert-Butyl Alcohol TBA</td>
<td>75-65-0</td>
<td>PID</td>
<td>100 ppm 1600 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>irritation to the eyes, skin, nose, throat; drowsiness, narcosis</td>
<td>Eye: Irrigate immediately; Skin: Water flush promptly; Breathing: Respiratory support; Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>tert-Butylbenzene t-Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene</td>
<td>98-06-6</td>
<td>PID</td>
<td>10 ppm NA</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, ingestion, skin, and/or eye contact</td>
<td>eye, skin, irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression</td>
<td>Eye: Irrigate immediately; Skin: Soap wash immediately; Breathing: Respiratory support; Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1 – 1.3.13</td>
<td>Tetrahydrofuran Diethylene oxide 1,4-Epoxybutane Tetramethylene oxide THF</td>
<td>109-99-9</td>
<td>PID</td>
<td>200 ppm 2000 ppm</td>
<td>Groundwater Soil Vapor</td>
<td>inhalation, skin, and/or eye contact, ingestion</td>
<td>irritation to the eyes, upper respiratory system; nausea, dizziness, headache, central nervous system depression</td>
<td>Eye: Irrigate immediately; Skin: Water flush promptly; Breathing: Respiratory support; Swallow: Medical attention immediately</td>
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</table>
| 1.3.1 – 1.3.13 | Thallium                                            | 7440-28-0  | None              | 0.1 mg/m³ 15 mg/m³ | Groundwater Soil               | inhalation, skin absorption, ingestion, skin, and/or eye contact       | nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; perineuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs | Eye: Irrigate immediately  
Skin: Water flush promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Toluene, Methyl benzene, Methyl benzol, Phenyl methane, Tolul | 108-88-3   | PID               | 200 ppm 500 ppm    | Groundwater Soil, Vapor        | inhalation, skin absorption, ingestion, skin, and/or eye contact       | irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis | Eye: Irrigate immediately  
Skin: Soap wash promptly  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Total PCBs Chlorodiphenyl (42% chlorine), Aroclor® 1242, PCB Polychlorinated biphenyl | 53469-21-9 | None              | 0.5 mg/m³ 5 mg/m³   | Groundwater Soil               | inhalation, skin absorption, ingestion, skin, and/or eye contact       | irritation to the eyes, chloracne                                      | Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
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</thead>
</table>
| 1.3.1 – 1.3.13 | Total Xylenes Dimethylbenzene Xylol                  | 1330-20-7  | PID               | 100 ppm  | Groundwater Soil Vapor         | inhalation, skin absorption, ingestion, skin, and/or eye contact | irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis | Eye: Irrigate immediately  
Skin: Soap flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Trans-Chlordane                                      | 5103-74-2  | None              | 0.5 mg/m³ 100 mg/m³ | Groundwater Soil | inhalation, skin absorption, ingestion, skin, and/or eye contact | Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria | Eye: Irrigate immediately  
Skin: Soap wash immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
| 1.3.1 – 1.3.13 | Trichlorofluoromethane Fluorotrichloromethane Freon® 11 | 75-69-4    | PID               | 1000 ppm 2000 ppm | Groundwater Soil Vapor | inhalation, ingestion, skin, and/or eye contact | incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite | Eye: Irrigate immediately  
Skin: Water flush immediately  
Breathing: Respiratory support  
Swallow: Medical attention immediately |
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<tr>
<td>1.3.1–1.3.13</td>
<td>Vanadium</td>
<td>7440-62-2</td>
<td>None</td>
<td>0.1 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation, skin absorption, ingestion, skin, and/or eye contact</td>
<td>nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; perineuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs</td>
<td>Eye: Irrigate immediately &lt;br&gt;Skin: Water flush promptly &lt;br&gt;Breathing: Respiratory support &lt;br&gt;Swallow: Medical attention immediately</td>
</tr>
<tr>
<td>1.3.1–1.3.13</td>
<td>Zinc</td>
<td>7440-62-2</td>
<td>None</td>
<td>15 mg/m³ 500 mg/m³</td>
<td>Groundwater Soil</td>
<td>inhalation</td>
<td>chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function</td>
<td>Breathing: Respiratory support</td>
</tr>
</tbody>
</table>

**EXPLANATION OF ABBREVIATIONS**

PID = Photoionization Detector  
PEL = Permissible Exposure Limit (8-hour Time Weighted Average)  
IDLH = Immediately Dangerous to Life and Health  
ppm = part per million  
mg/m³ = milligrams per cubic meter  
500 mg/m³
### TABLE 3
SUMMARY OF MONITORING EQUIPMENT

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hazard Monitored</th>
<th>Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photoionization Detector (PID)</td>
<td>Many organic and some inorganic gases and vapors.</td>
<td><strong>Application:</strong> Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. <strong>Detection Method:</strong> Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. <strong>General Care/Maintenance:</strong> Recharge or replace battery. Regularly clean lamp window. <strong>Typical Operating Time:</strong> 10 hours. 5 hours with strip chart recorder.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hazard Monitored</th>
<th>Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen Meter</td>
<td>Oxygen (O\textsubscript{2}).</td>
<td><strong>Application:</strong> Measures the percentage of O\textsubscript{2} in the air. <strong>Detection Method:</strong> Uses an electrochemical sensor to measure the partial pressure of O\textsubscript{2} in the air and converts the reading to O\textsubscript{2} concentration. <strong>General Care/Maintenance:</strong> Replace detector cell according to manufacturer’s recommendations. Recharge or replace batteries prior to explanation of the specified interval. If the ambient air is less than 0.5% CO\textsubscript{2}, replace the detector cell frequently. <strong>Typical Operating Time:</strong> 8 – 12 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hazard Monitored</th>
<th>Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible Gas Indicator (CGI)</td>
<td>Combustible gases and vapors.</td>
<td><strong>Application:</strong> Measures the concentration of combustible gas or vapor. <strong>Detection Method:</strong> A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. <strong>General Care/Maintenance:</strong> Recharge or replace battery. Calibrate immediately before use. <strong>Typical Operating Time:</strong> Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hazard Monitored</th>
<th>Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame Ionization Detector (FID) with Gas Chromatography Option (i.e., Foxboro Organic Vapor Analyzer (OVA))</td>
<td>Many organic gases and vapors (approved areas only).</td>
<td><strong>Application:</strong> In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. <strong>General Care/Maintenance:</strong> Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. <strong>Typical Operating Time:</strong> 8 hours; 3 hours with strip chart recorder.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hazard Monitored</th>
<th>Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potable Infrared (IR) Spectrophotometer</td>
<td>Many gases and vapors.</td>
<td><strong>Application:</strong> Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. <strong>Detection Method:</strong> Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. <strong>General Care/Maintenance:</strong> As specified by the manufacturer.</td>
</tr>
<tr>
<td>Instrument</td>
<td>Operation Parameters</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| Direct Reading Colorimetric Indicator Tube | **Hazard Monitored:** Specific gas and vapors.  
**Application:** Measures concentration of specific gases and vapors.  
**Detection Method:** The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound’s concentration.  
**General Care/Maintenance:** Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling. |
| Aerosol Monitor                        | **Hazard Monitored:** Airborne particulate (dust, mist, fume) concentrations.  
**Application:** Measures total concentration of semi-volatile organic compounds, PCBs, and metals.  
**Detection Method:** Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles.  
**General Care/Maintenance:** As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air. |
| Monitox                                | **Hazard Monitored:** Gases and vapors.  
**Application:** Measures specific gases and vapors.  
**Detection Method:** Electrochemical sensor specific for the chemical species in question.  
**General Care/Maintenance:** Moisten sponge before use; check the function switch; change the battery when needed.                                                                                                                                                                           |
| Gamma Radiation Survey Instrument      | **Hazard Monitored:** Gamma Radiation.  
**Application:** Environmental radiation monitor.  
**Detection Method:** Scintillation detector.  
**General Care/Maintenance:** Must be calibrated annually at a specialized facility.  
**Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.                                                                                                                                                              |
### TABLE 4
INSTRUMENTATION ACTION LEVELS

<table>
<thead>
<tr>
<th>Photoionization Detector Action Levels</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background to 5-parts per million (ppm)(^1)</td>
<td>No respirator needed; no further action</td>
</tr>
</tbody>
</table>
| >5ppm but \(\leq\) 15 ppm at the perimeter of the work area | • Work temporarily halted and monitoring continues.  
• If instantaneous readings decrease below 5 ppm above background, work activities will resume with continued monitoring |
| >5ppm but \(\leq\) 25 ppm at the downwind perimeter of the hot zone | • Work activities will be halted.  
• Source of vapors identified.  
• Corrective actions taken to abate emissions.  
• Continued monitoring.  
• Workers will don appropriate respirators and work can resume if vapor levels 200-feet downwind or the hot zone or half the distance to the nearest potential receptor or residential or commercial structure, whichever is less – but in no case less than 20-feet – is below 5 ppm above background for the 15-minute average |
| >25ppm at the parameter of the hot zone | Activities will shut down |

<table>
<thead>
<tr>
<th>Particulate Monitoring Action Levels</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background to 100-micrograms per cubic meter (µg/m(^3))(^2), no dust observed</td>
<td>No further action</td>
</tr>
<tr>
<td>Background to 100 µg/m(^3), dust observed leaving the work area</td>
<td>Dust suppression must be employed.</td>
</tr>
</tbody>
</table>
| 100 to 150 µg/m\(^3\) at the downwind parameter of the hot zone | • Work activities will be halted.  
• Source of dust identified.  
• Dust suppression activities initiated.  
• Corrective actions taken to abate emissions.  
• Continued monitoring.  
• Workers will don appropriate respirators.  
• Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m\(^3\) of the upwind level and in preventing visible dust migration. |
| >150 µg/m\(^3\) at the parameter of the hot zone | Activities will shut down |

\(^1\) VOC concentrations are 15-minute averages above site background (upwind parameter)  
\(^2\) Particulate concentrations are 15-minute averages above site background (upwind parameter)
# Table 5
## Emergency Notification List

<table>
<thead>
<tr>
<th>Organization</th>
<th>Contact</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Police Department</td>
<td></td>
<td>911</td>
</tr>
<tr>
<td>Local Fire Department</td>
<td></td>
<td>911</td>
</tr>
<tr>
<td>Ambulance/Rescue Squad</td>
<td></td>
<td>911</td>
</tr>
<tr>
<td>Hospital</td>
<td>NYC Health and Hospitals/Jacobi Medical Center</td>
<td>911 or 718-918-5000</td>
</tr>
<tr>
<td>Langan Incident Hotline</td>
<td></td>
<td>800-952-6426 extension 4699</td>
</tr>
<tr>
<td>Medical Treatment Hotline</td>
<td>WorkCare™</td>
<td>911 or 888-449-7757</td>
</tr>
<tr>
<td>Langan Environmental Project Manager</td>
<td>Lamees Esmail</td>
<td>919-694-3345 (cell)</td>
</tr>
<tr>
<td>Langan Health and Safety Manager (HSM)</td>
<td>Tony Moffa</td>
<td>215-756-2523 (cell)</td>
</tr>
<tr>
<td>Langan Health &amp; Safety Officer (HSO)</td>
<td>William Bohrer</td>
<td>410-984-3068 (cell)</td>
</tr>
<tr>
<td>Langan Field Team Leader (FTL)</td>
<td>Meghan Aronica</td>
<td>716-525-7260 (cell)</td>
</tr>
<tr>
<td>Client’s Representative</td>
<td>Jeff Knecht</td>
<td>646-439-4000</td>
</tr>
<tr>
<td>National Response Center (NRC)</td>
<td></td>
<td>800-424-8802</td>
</tr>
<tr>
<td>Chemical Transportation Emergency Center (Chemtrec)</td>
<td></td>
<td>800-424-9300</td>
</tr>
<tr>
<td>Center for Disease Control (CDC)</td>
<td></td>
<td>404-639-3534</td>
</tr>
<tr>
<td>EPA (RCRA Superfund Hotline)</td>
<td></td>
<td>800-424-9346</td>
</tr>
<tr>
<td>TSCA Hotline</td>
<td></td>
<td>202-554-1404</td>
</tr>
<tr>
<td>Poison Control Center</td>
<td></td>
<td>800-222-1222</td>
</tr>
</tbody>
</table>

Immediately following an injury, unless immediate emergency medical treatment is required, the injured employee must contact WorkCare - Incident Intervention® at 888-449-7787.

For all other incidents or near misses, unless emergency response is required, either the employee or a coworker must contact the Langan Incident Hotline at 973-560-4699.
TABLE 6
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS

<table>
<thead>
<tr>
<th>Adjusted Temperature&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Normal Work Ensemble&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Impermeable Ensemble</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°F or above (32.2°C) or above</td>
<td>After each 45 min. of work</td>
<td>After each 15 min. of work</td>
</tr>
<tr>
<td>87.5°F (30.8°-32.2°C)</td>
<td>After each 60 min. of work</td>
<td>After each 30 min. of work</td>
</tr>
<tr>
<td>82.5°F-87.5°F (28.1°-30.8°C)</td>
<td>After each 90 min. of work</td>
<td>After each 60 min. of work</td>
</tr>
<tr>
<td>77.5°F-82.5°F (25.3°-28.1°C)</td>
<td>After each 120 min. of work</td>
<td>After each 90 min. of work</td>
</tr>
<tr>
<td>72.5°F-77.5°F (22.5°-25.3°C)</td>
<td>After each 150 min. of work</td>
<td>After each 120 min. of work</td>
</tr>
</tbody>
</table>

<sup>a</sup> For work levels of 250 kilocalories/hour.
<sup>b</sup> Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
<sup>c</sup> A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
**TABLE 7**

**HEAT INDEX**

<table>
<thead>
<tr>
<th>RELATIVE HUMIDITY</th>
<th>APPARENT TEMPERATURE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>64 69 73 78 83 87 91 95 99 103 107</td>
</tr>
<tr>
<td>10%</td>
<td>65 70 75 80 85 90 95 100 105 111 116</td>
</tr>
<tr>
<td>20%</td>
<td>66 72 77 82 87 93 99 105 112 120 130</td>
</tr>
<tr>
<td>30%</td>
<td>67 73 78 84 90 96 104 113 123 135 148</td>
</tr>
<tr>
<td>40%</td>
<td>68 74 79 86 93 101 110 123 137 151</td>
</tr>
<tr>
<td>50%</td>
<td>69 75 81 88 96 107 120 135 150</td>
</tr>
<tr>
<td>60%</td>
<td>70 76 82 90 100 114 132 149</td>
</tr>
<tr>
<td>70%</td>
<td>70 77 85 93 106 124 144</td>
</tr>
<tr>
<td>80%</td>
<td>71 78 86 97 113 136</td>
</tr>
<tr>
<td>90%</td>
<td>71 79 88 102 122</td>
</tr>
<tr>
<td>100%</td>
<td>72 80 91 108</td>
</tr>
</tbody>
</table>

*Combined Index of Heat and Humidity...what it "feels like" to the body

Source: National Oceanic and Atmospheric Administration

How to use Heat Index:
1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

<table>
<thead>
<tr>
<th>Apparent Temperature</th>
<th>Heat Stress Risk with Physical Activity and/or Prolonged Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-105</td>
<td>Heat Cramps or Heat Exhaustion Possible</td>
</tr>
<tr>
<td>105-130</td>
<td>Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible</td>
</tr>
<tr>
<td>&gt;130</td>
<td>Heatstroke Highly Likely</td>
</tr>
</tbody>
</table>
FIGURES
FIGURE 2
HOSPITAL ROUTE PLAN

Hospital Location: NYC Health and Hospitals/Jacobi Medical Center
1400 Pelham Turnpike South
Bronx, New York
719-918-5000

START: 2560-2580 Boston Road, Bronx, NY
1. Head northeast on Boston Rd toward Matthews Ave
2. Slight right onto Alleton Ave
3. Turn left onto Pelham Pkwy S
4. Slight right to stay on Pehlham Pkwy S
5. Keep left to stay on Pehlham Pkwy S, destination will be your right.

END: NYC Health and Hospitals/Jacobi Medical Center, 1400 Pelham Turnpike South, Bronx, New York
ATTACHMENTS
ATTACHMENT A

STANDING ORDERS
STANDING ORDERS

GENERAL

- No smoking, eating, or drinking in this work zone.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Always use the appropriate level of personal protective equipment (PPE).
- Maintain close contact with your buddy in the work zone.
- Contaminated material will be contained in the Exclusion Zone (EZ).
- Report any unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site HSO.

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carry passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10-feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to ensure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signal operator to direct backing, as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.
ATTACHMENT B

DECONTAMINATION PROCEDURES
PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

Station 1: Equipment Drop
1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse
2. Scrub outer boots, outer gloves, and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.

Station 3: Outer Boot and Glove Removal
3. Remove outer boots and gloves. Deposit in container with plastic liner.

Station 4: Canister or Mask Change
4. If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker’s canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.

Station 5: Boot, Gloves and Outer Garment Removal
5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.

Station 6: Face piece Removal
6. Face piece is removed (avoid touching face with fingers). Face piece deposited on plastic sheets.

Station 7: Field Wash
7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1: Equipment Drop
1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.

Station 2: Outer Garment, Boots, and Gloves Wash and Rinse
2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.

Station 3: Outer Boot and Glove Removal
3. Remove outer boots and gloves. Deposit in container with plastic liner.

Station 4: Boot, Gloves and Outer Garment Removal
4. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.

Station 5: Field Wash
5. Hands and face are thoroughly washed. Shower as soon as possible.
EQUIPMENT DECONTAMINATION

**GENERAL:**

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment, and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site HSO. The decontamination work tasks will be split or rotated among support and work crews.

Depending on site conditions, backhoes and pumps may be decontaminated over a portable decontamination pad to contain wash water; or wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic bucket, tub, or other containers. They will be brushed off and rinsed with a detergent solution, and finally rinsed with clean water.

**MONITORING EQUIPMENT:**

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as many of the instruments as possible with plastic without hindering the operation of the unit. The PID, HNu, or OVA meter, for example, can be placed in a clear plastic bag, which allows reading of the scale and operation of knobs. The probes can be partially wrapped keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

**RESPIRATORS:**

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.
ATTACHMENT C

EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT
EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee Name: ___________________________ Date: ___________________________

Incident type: □ Injury □ Report Only/No Injury
□ Near Miss □ Other: ___________________________

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: ___________________________ Employee No: ___________________________

Title: ___________________________ Office Location: ___________________________

Length of time employed or date of hire: ___________________________

Mailing address: ___________________________

Sex: □ M □ F Birth date: ___________________________

Business phone & extension: ___________________________ Residence/cell phone: ___________________________

ACCIDENT INFORMATION

Project: ___________________________ Project #: ___________________________

Date & time of incident: ____________ Time work started & ended: ____________

Site location: ___________________________

Incident Type: Possible Exposure □ Exposure □ Physical Injury □
Possible causes of the incident (equipment, unsafe work practices, lack of PPE, etc.):


Weather conditions during incident:


MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

If Yes, when and where was medical care received:


Provide name of facility (hospital, clinic, etc.):


Length of stay at the facility?


Did the employee miss any work time? Yes ☐ No ☐ Undetermined ☐

Date employee last worked: __________________________ Date employee returned to work:


Has the employee returned to work? Yes ☐ No ☐

Does the employee have any work limitations or restrictions from the injury? Yes ☐ No ☐

If Yes, please describe:


Did the exposure/injury result in permanent disability? Yes ☐ No ☐ Unknown ☐

If Yes, please describe:


HEALTH & SAFETY INFORMATION
Was the operation being conducted under an established site-specific HEALTH AND SAFETY PLAN?
Yes ☐  No ☐  Not Applicable: ☐

Describe protective equipment and clothing used by the employee:
________________________________________________________________________
________________________________________________________________________

Did any limitations in safety equipment or protective clothing contribute to or affect exposure/injury? If so, explain:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

________________________________________________________________________

Employee Signature ___________________________ Date __________

________________________________________________________________________

Langan Representative ___________________________ Date __________
ATTACHMENT D

CALIBRATION LOG
<table>
<thead>
<tr>
<th>Date &amp; Time</th>
<th>Inst Type</th>
<th>Inst #</th>
<th>Media</th>
<th>Initial Reading</th>
<th>Span #</th>
<th>Calibrate Reading</th>
<th>Performed By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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All Langan Field Personnel Completing This Work Plan Are To Have Real-Time Accessibility To Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDSs) Through Their Smart Phone.

The link is http://www.msds.com/
The login name is “drapehead”
The password is “2angan987”

If You Are Unable To Use the Smart Phone App, You Are To Bring Printed Copies of the MSDS/SDSs to the Site
ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST
 Jobsite Safety Inspection Checklist

Date: _______________ Inspected By: _______________________

Location: _______________ Project #: _______________________

Check one of the following: A: Acceptable  NA: Not Applicable  D: Deficiency

<table>
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<tr>
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<th>A</th>
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<td>23. Adequate size/type fire extinguisher supplied?</td>
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<td>24. Equipment at least 20-feet from overhead powerlines?</td>
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<tr>
<td>25. Evidence that drilling operator is responsible for the safety of his rig.</td>
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<td>26. Trench sides shored, layer back, or boxed?</td>
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<td>27. Underground utilities located and authorities contacted before digging?</td>
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<td>28. Ladders in trench (25-foot spacing)?</td>
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<td>29. Excavated material placed more than 2-feet away from excavation edge?</td>
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<td>30. Public protected from exposure to open excavation?</td>
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<tr>
<td>31. People entering the excavation regarding it as a permit-required confined space and following appropriate procedures?</td>
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<tr>
<td>32. Confined space entry permit is completed and posted?</td>
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<tr>
<td>33. All persons knowledgeable about the conditions and characteristics of the confined space?</td>
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<tr>
<td>34. All persons engaged in confined space operations have been trained in safe entry and rescue (non-entry)?</td>
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<td>35. Full body harnesses, lifelines, and hoisting apparatus available for rescue needs?</td>
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<td>36. Attendant and/or supervisor certified in basic first aid and CPR?</td>
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<td>37. Confined space atmosphere checked before entry and continuously while the work is going on?</td>
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<td>38. Results of confined space atmosphere testing recorded?</td>
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<tr>
<td>39. Evidence of coordination with off-site rescue services to perform entry rescue, if needed?</td>
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<td>40. Are extension cords rated for this work being used and are they properly maintained?</td>
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<tr>
<td>41. Are GFCIs provided and being used?</td>
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Unsafe Acts:

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Notes:

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ATTACHMENT G

JOB SAFETY ANALYSIS FORM
Langan employees must review and revise the Job Safety Analysis (JSA) as needed to address any site specific hazards not identified. Employees must provide their signatures on the last page of the JSA indicating they have reviewed the JSA and are aware of the potential hazards associated with this work and will follow the provided preventive or corrective measures.

<table>
<thead>
<tr>
<th>PERSONAL PROTECTIVE EQUIPMENT REQUIRED: (PPE):</th>
<th>□ Required</th>
<th>☒ As Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel-toed boots</td>
<td>□ Nitrile gloves</td>
<td>□ Dermal Protection (Specify)</td>
</tr>
<tr>
<td>Long-sleeved shirt</td>
<td>□ Leather/Cut-resistant gloves</td>
<td>□ High visibility vest/clothing</td>
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<tr>
<td>Safety glasses</td>
<td>□ Face Shield</td>
<td>□ Hard hat</td>
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</table>

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<tr>
<th>ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT NEEDED (Provide specific type(s) or descriptions)</th>
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<tr>
<td>□ Air Monitoring:</td>
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<tr>
<td>□ Respirators:</td>
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<td>□ Other:</td>
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<tr>
<td>□ Dermal Protection:</td>
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<tr>
<td>□ Cartridges:</td>
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<td>□ Other:</td>
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<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE OR CORRECTIVE ACTION</th>
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<td>1.</td>
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<tr>
<td>Additional items identified in the field.</td>
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Additional Items.

If additional items are identified during daily work activities, please notify all relevant personnel about the change and document on this JSA.
**JOB STEPS**

<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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</thead>
</table>
| 1. All Activities | 1. Transmittal/exposure of COVID-19 | 1. Ask yourself and your managers – is this work essential? Can this be done remotely?  
2. Stay home if sick or showing symptoms of COVID-19 (e.g. fever, cough, etc.).  
3. Carry nitrile gloves, alcohol-based hand sanitizer, face coverings and disinfectant wipes/spray during field work.  
4. Check federal, state, and/or local travel restrictions prior to travel. Many states, counties, and cities are passing strict “shelter-in-place” or business restrictions in response to COVID-19.  
5. Immediately notify Beverly Williams or Rory Johnston (Supervisor if employee chooses) if you display symptoms of COVID-19. Symptoms include fever (over 100.4 F), cough, and shortness of breath.  
6. Notify Beverly Williams or Rory Johnston, Supervisor and Coronavirus Task Force if you had close contact with an individual who tested positive or displayed symptoms of COVID-19.  
7. Do not touch your face, to the extent possible.  
8. Wear face coverings when around other worker to minimize spread of COVID-19. (May be required in certain states or locations.) |
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<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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<tr>
<td></td>
<td>9. Practice social distancing, maintaining at least 6-feet of distance between you and others. Avoid gatherings of more than 10-people. Limit, to the extent possible, contact with public items/objects.</td>
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<td>10. Clean your hands frequently with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, sneezing, or using the rest room.</td>
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<td>11. If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry.</td>
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<td>12. Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow.</td>
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<td>13. Clean and disinfect frequently touched surfaces daily, for example, cell phones, computer equipment, headsets, tables, doorknobs, light switches, countertops, handles, desks, toilets, faucets, and sinks.</td>
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<td>1. Transmittal/exposure of COVID-19 between passengers</td>
<td>1. Limit the number of occupants to each vehicle to two people. Employees should sit as far away from each other as possible.</td>
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<td>2. Transmittal/exposure of COVID-19 from previous occupants (rental and fleet vehicles)</td>
<td>2. Disinfect high “hand-traffic” areas of the vehicle: Door handles, steering wheel, turn signal and control rods, dashboard controls, seatbelts, armrests, etc. To the extent possible, do not use recycled air for heat/AC and travel with the windows open.</td>
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<td>3. Transmittal/exposure of COVID-19 while refueling</td>
<td>3. Use hand sanitizer before and after pumping gas and only return to the inside of the vehicle after refueling is complete.</td>
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<td>4. Wear nitrile gloves if available or disinfect the key pad, pump handle, and fuel grade button prior to use.</td>
<td>4. Wear nitrile gloves and head coverings to minimize spread of COVID-19.</td>
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<td>5. Recommend face coverings are worn to minimize spread of COVID-19.</td>
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<td>1. Transmittal/exposure of COVID-19 between meeting participants</td>
<td>1. Practice social distancing, maintaining at least 6-feet of distance between yourself and others.</td>
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<td>2. Recommend face coverings are worn when around other workers to minimize spread of COVID-19,</td>
<td>2. To the extent possible, do not interact with the public. If it is necessary, politely explain you are practicing social distance and request they stay at least 6-feet away and they do not attempt to pass objects to you.</td>
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<td>3. Hold meetings outside and keep in mind wind direction. To the extent possible, remain cross-wind from other people.</td>
<td>3. Wear nitrile gloves during site work underneath the appropriate gloves for your task. Utilize appropriate decontamination procedures, securely bag all waste (including nitrile gloves) generated during site work and dispose of.</td>
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<td>4. Designate a single person to maintain sign-in sheets/permits throughout the day to limit the passing of pens/clipboards between people.</td>
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<td>5. Each person should complete their own JSA, even if they are completing similar tasks as others in order to limit the passing of paper/pens/clipboards between people.</td>
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<td>6. Include COVID-19 topics and prevention measures in safety meetings.</td>
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<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>PREVENTATIVE / CORRECTIVE ACTION</td>
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<td>5. Do not share tools. Each person should be equipped with the tools to complete their task or tasks should be divided to remove the need to share tools. If tools must be shared, surfaces should be disinfected.</td>
<td>5. Use of Construction Trailers 1. Transmittal/exposure of COVID-19 between site workers and others.</td>
<td>1. Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. 2. Practice social distancing; maintaining 6-feet of distance between yourself and others in trailer. 3. Clean and disinfect areas including desks, phones, chairs, and other common areas, before and after use.</td>
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<td>6. Clean and disinfect surfaces of rental tools and equipment upon receipt. To the extent possible rent equipment from Langan’s internal equipment reservation center, where cleaning/disinfecting procedures can be verified.</td>
<td>6. Purchasing Food from a Restaurant 1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.</td>
<td>1. To the extent possible, bring your own food. 2. If you must visit a restaurant, call ahead for take-out or “contactless delivery.” Do not dine in. When picking up food, follow guidelines for Job Step #8: Purchasing Supplies at Retail/Shipping Centers. 3. Wash hands before and after eating.</td>
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<td>7. Smoking Cigarettes 1. Transmittal/exposure of COVID-19 by touching mouth with hands</td>
<td>7. Hotel Stay 1. Transmittal/exposure of COVID-19 from previous occupants, hotel staff, common areas.</td>
<td>1. Cigarette smokers are at greater risk of complications arising from COVID-19. Nicotine patches/lozenges/gum, smoking cessation programs, and prescription medications may aid in “kicking the habit” if you decide to quit. 2. Wash hands thoroughly before and after smoking. 3. Discard cigarette butts properly. Do not light cigarettes from others and do not give cigarettes to others. 4. Verify the hotel chain/brand has modified cleaning procedures to reflect risk of COVID-19. Most hotel companies have issued statements on their websites and in email blasts reflecting these new procedures. 5. Use the front door, and not peripheral entrances. Front doors of hotels are automatic. 6. Request ground floor room to avoid elevator use and a room that has not been utilized in 48-72 hours. 7. If elevator use is required, do not directly touch elevator buttons with your hands. Do not ride elevators with other people, to the extent possible. 8. Bring disinfecting wipes or sanitizing spray. Upon arrival, disinfect high “hand-traffic” areas of the hotel room: Door handles, light switches, shower/sink faucet handles, TV remote, curtain/blind handles. Clean these surfaces daily. 9. Place the “Do Not Disturb” Sign on your door to prevent people (housekeeping) from entering your room. 10. Avoid common spaces and hotel sponsored events where crowds will be present. 11. Confirm hotel cleaning procedures have been modified to address COVID-19. Confirm no COVID-19 cases have occurred in hotel.</td>
</tr>
<tr>
<td>9. Purchasing Supplies at Retail/Shipping Centers 1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.</td>
<td>9. Purchasing Supplies at Retail/Shipping Centers</td>
<td>1. Plan your travel to limit the need to visit retail/shipping centers. 2. Practice social distancing, maintaining at least 6-feet of distance between yourself and others. If the store is too crowded/small, consider visiting another store or returning at a different time. 3. Avoid high “hand-traffic” items/areas like door handles (i.e. use your shoulder, hip/butt, or open with a disposable napkin/paper towel), credit cards terminals (i.e. use Apple/Android pay if available), shopping carts/baskets (i.e. bring your own shopping bags), counter tops (i.e. ask clerk if you can hold the items while they are scanned) and bulk/buffet items (i.e. just avoid them).</td>
</tr>
<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>PREVENTATIVE / CORRECTIVE ACTION</td>
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<td>4. Disinfect your hands before and after visiting a retail/shipping center.</td>
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**Prepared by:**

**Reviewed by:**
**JSA Title:** Environmental Sampling  
**JSA Number:** JSA021-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.

<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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</thead>
<tbody>
<tr>
<td>1. Drive to sample location</td>
<td>1. Rough/Off Road terrain</td>
<td>1. Pay attention to road conditions such as road erosion, unprotected embankments, and soft road conditions.</td>
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</tbody>
</table>
| 2. Sample Collection (Walking) | 1. Slip/Trips/Falls  
2. Back strains  
3. Wildlife (Insects, Stray animals, rodents)  
4. Poisonous vegetation | 1. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles.  
2. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe and unsafe to carry.  
3. Be aware of surroundings for the presence of wildlife. Do not approach stray animals. Carry and use animal repellent when needed/ Use bug spray when needed.  
4. Keep skin covered/ Identify and avoid poisonous vegetation/ Clean areas after contact with suspected vegetation. |
| 3. Sample Collection (Water) | 1. Drowning Hazards  
2. Chemical burns (when adding acid preservative to sample)  
3. Back Strains  
4. Ergonomic issues  
5. Slip/Trips/Falls | 1. Use buddy system/ Wear flotation vest if water is deeper than 2-feet or swift moving/ Select working area with stable footing. Do not attempt to cross or stand in swift moving water.  
2. Wear proper PPE (Nitrile gloves, Tyvek Sleeves)  
3. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe or unsafe to carry.  
4. When possible avoid bending over for long periods of time/ Use a small stool for sitting or knee pad for kneeling. |

**PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):**

- Safety Shoes  
- Long Sleeves  
- Safety Vest (Class 2)  
- Hard Hat  
- Hearing Protection
- Safety Glasses  
- Safety Goggles  
- Face Shield  
- Nitrile Gloves  
- PVC Gloves
- Leather Gloves  
- Cut Resist. Gloves  
- Fall Protection  
- Fire Resistant Clothing  
- Rubber Boots
- Insect/Animal Repellent  
- Ivy Blocker/Cleaner  
- Traffic Cones/Signs  
- Life Vest/Jacket
- Other: Tyvek Sleeves
<table>
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<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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<td></td>
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<td>5. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles/ Avoid standing water or slippery terrain.</td>
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<td>4. All activities</td>
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</thead>
<tbody>
<tr>
<td>5. Transport equipment to work area</td>
<td>2. Back/strain</td>
<td>1. Use proper lifting techniques/Use wheeled transport</td>
</tr>
<tr>
<td></td>
<td>3. Slip/Trip/Falls</td>
<td>2. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures</td>
</tr>
<tr>
<td></td>
<td>4. Traffic</td>
<td>3. Wear proper PPE (high visibility vest or clothing)</td>
</tr>
<tr>
<td></td>
<td>5. Cuts/abrasions/contusions from equipment</td>
<td>4. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)</td>
</tr>
<tr>
<td></td>
<td>6. Accidents due to vehicle operations</td>
<td>5. Observe posted speed limits/ Wear seat belts at all times</td>
</tr>
<tr>
<td>6. Traffic</td>
<td>1. Hit by moving vehicle</td>
<td></td>
</tr>
<tr>
<td>7. Field Work (drilling, resistivity testing, and inspection)</td>
<td>1. Biological Hazards: insects, rats, snakes, poisonous plants, and other animals</td>
<td>1. Inspect work area to identify biological hazards. Wear light colored long sleeve shirt and long pants/ Use insect repellent as necessary/ Beware of tall grass, bushes, woods and other areas where ticks may live/ Avoid leaving garbage on site to prevent attracting animals/ Identify and avoid contact with poisonous plants/Beware of rats, snakes, or stray animals.</td>
</tr>
<tr>
<td></td>
<td>2. Heat stress/injuries</td>
<td>2. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block</td>
</tr>
<tr>
<td></td>
<td>3. Cold Stress/injuries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. High Energy Transmission Lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Underground Utilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Electrical (soil resistivity testing)</td>
<td></td>
</tr>
</tbody>
</table>

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

- Safety Shoes
- Long Sleeves
- Safety Vest (Class 2)
- Hard Hat
- Hearing Protection
- Safety Glasses
- Safety Goggles
- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resist. Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other: Dielectric Overshoes, Sun Block
<table>
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<tr>
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<tbody>
<tr>
<td>5. Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. See AGI Sting R1 operating manual for specific concerns during operating instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. All activities</td>
<td>1. Slips/ Trips/ Falls</td>
<td>7. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards</td>
</tr>
<tr>
<td></td>
<td>2. Hand injuries, cuts, or lacerations during manual handling of materials</td>
<td>8. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves</td>
</tr>
<tr>
<td></td>
<td>3. Foot injuries</td>
<td>9. Wear Langan approved safety shoes</td>
</tr>
<tr>
<td></td>
<td>4. Back injuries</td>
<td>10. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
</tr>
<tr>
<td></td>
<td>5. Traffic</td>
<td>11. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
</tr>
<tr>
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<td>6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)</td>
<td>12. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed</td>
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<tr>
<td></td>
<td>7. High Noise levels</td>
<td>13. Wear proper hearing protection</td>
</tr>
<tr>
<td></td>
<td>8. Overhead hazards</td>
<td>14. Wear hard hat / Avoid areas were overhead hazards exist.</td>
</tr>
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<td>9. Heat Stress/ Cold Stress</td>
<td>15. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
<tr>
<td></td>
<td>10. Eye Injuries</td>
<td>16. Wear safety glasses</td>
</tr>
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### PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

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<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Safety Shoes</td>
</tr>
<tr>
<td>Long Sleeves</td>
</tr>
<tr>
<td>Safety Vest (Class 2)</td>
</tr>
<tr>
<td>Hard Hat</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Safety Goggles</td>
</tr>
<tr>
<td>Face Shield</td>
</tr>
<tr>
<td>Nitrile Gloves</td>
</tr>
<tr>
<td>PVC Gloves</td>
</tr>
<tr>
<td>Leather Gloves</td>
</tr>
<tr>
<td>Cut Resist. Gloves</td>
</tr>
<tr>
<td>Fall Protection</td>
</tr>
<tr>
<td>Fire Resistant Clothing</td>
</tr>
<tr>
<td>Rubber Boots</td>
</tr>
<tr>
<td>Insect/Animal Repellent</td>
</tr>
<tr>
<td>Ivy Blocker/Cleaner</td>
</tr>
<tr>
<td>Traffic Cones/Signs</td>
</tr>
<tr>
<td>Life Vest/Jacket</td>
</tr>
<tr>
<td>Other:</td>
</tr>
</tbody>
</table>

### JOB STEPS

<table>
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<tr>
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<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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</thead>
<tbody>
<tr>
<td>9. Unpack/Transport equipment to work area.</td>
<td>7. Back Strains</td>
<td>6. Use proper lifting techniques/Use wheeled transport</td>
</tr>
<tr>
<td></td>
<td>8. Slip/Trips/Falls</td>
<td>7. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones.</td>
</tr>
<tr>
<td></td>
<td>9. Cuts/Abrasions from equipment</td>
<td>8. Wear proper PPE (leather gloves, long sleeves).</td>
</tr>
<tr>
<td>10. Initial Site Arrival-Site Assessment</td>
<td>5. Traffic</td>
<td>5. Situational awareness (be alert of your surroundings). Secure area from through traffic.</td>
</tr>
<tr>
<td>11. Surface Water Sampling</td>
<td>6. Contaminated media. Skin/eye contact with biological agents and/or chemicals.</td>
<td>6. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (M)SDS for all chemicals being.</td>
</tr>
<tr>
<td>13. Icing of Samples/Transporting coolers/equipment from work area.</td>
<td>11. Back Strains</td>
<td>17. Drain coolers of water. Use proper lifting techniques. Use wheeled transport</td>
</tr>
<tr>
<td></td>
<td>13. Cuts/Abrasions from equipment</td>
<td>19. Wear proper PPE (Leather gloves, long sleeves)</td>
</tr>
<tr>
<td></td>
<td>14. Pinch/Crushing Hazards.</td>
<td>20. Wear proper PPE (Leather gloves, long sleeves)</td>
</tr>
<tr>
<td>JOB STEPS</td>
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<td>-----------</td>
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<td>----------------------------------</td>
</tr>
</tbody>
</table>
| 15. All activities | 1. Slips/ Trips/ Falls  
2. Hand injuries, cuts, or lacerations during manual handling of materials  
3. Foot injuries  
4. Back injuries  
15. Traffic  
16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)  
17. High Noise levels  
18. Overhead hazards  
19. Heat Stress/ Cold Stress  
20. Eye Injuries | 1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards  
2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery, or dirty objects before handling / Wear leather/ cut-resistant gloves  
3. Wear Langan approved safety shoes  
4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible  
21. Wear high visibility clothing & vest / Use cones or signs to designate work area  
22. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed  
23. Wear hearing protection  
24. Wear hard hat / Avoid areas were overhead hazards exist.  
25. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress  
26. Wear safety glasses |

Additional items.

Additional Items identified while in the field.

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| 16. Transport equipment to work area | 11. Back Strain  
12. Slips/ Trips/ Falls  
13. Traffic  
14. Cuts/abrasions from equipment  
15. Contusions from dropped equipment | 1. Use proper lifting techniques / Use wheeled transport  
2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures  
3. Wear proper PPE (high visibility vest or clothing)  
4. Wear proper PPE (leather gloves, long sleeves)  
5. Wear proper PPE (safety shoes) |
| 17. Moving equipment to its planned location | 6. Pinch Hazard  
7. Slips/ Trips/ Falls | 1. Wear proper PPE (leather gloves)  
2. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint |
| 18. Equipment Set-up | 7. Pinch Hazard  
8. Cuts/abrasions to knuckles/hands  
2. Wear proper PPE (leather gloves)  
3. Use proper lifting techniques / Use wheeled transport |
| 19. All activities | 21. Slips/ Trips/ Falls  
22. Hand injuries, cuts, or lacerations during manual handling of materials  
23. Foot injuries  
24. Back injuries  
25. Traffic  
26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) | 27. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards  
28. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves  
29. Wear Langan approved safety shoes |
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<tr>
<td>4.</td>
<td>All activities (cont’d)</td>
<td>30. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
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<td></td>
<td></td>
<td>31. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
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<td>32. Be aware of surroundings at all times, including the presence of wildlife / Do not approach stray dogs / Carry/use dog/animal repellent / Use bug spray when needed</td>
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<tr>
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<td></td>
<td>33. Wear hearing protection</td>
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<td>34. Wear hard hat / Avoid areas were overhead hazards exist.</td>
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<td></td>
<td>35. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
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<td>36. Wear safety glasses</td>
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<td>Additional items.</td>
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| 20. Unpack/Transport equipment to work area. | 16. Back Strains  
17. Slip/Trips/Falls  
18. Cuts/Abrasions from equipment  
4. Contusions from dropped equipment | 10. Use proper lifting techniques/Use wheeled transport  
11. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones.  
12. Wear proper PPE (leather gloves, long sleeves).  
4. Wear proper PPE (Langan approved safety shoes). |
| 21. Open Drums                    | 1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.  
2. Pressure from drums.            | 1. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery, or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches.  
2. Open drum slowly to relieve pressure. Wear proper PPE: face shield and goggles; correct gloves; and over garments. |
| 22. Collecting Soil/Fluid Sample  | 8. Irritation to eye from vapor, soil dust, or splashing  
9. Irritation to exposed skin     | 6. Wear proper eye protection including safety glasses/ face shield/googles and when necessary, splash guard. If dust or vapor phase is present, wear appropriate safety breathing gear (1/2 mask or full face mask with correct filter)  
7. Wear proper skin protection including nitrile gloves. |
| 23. Closing Drums                 | 1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. | 7. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery, or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. |

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

- Safety Shoes
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- Hard Hat
- Hearing Protection
- Safety Glasses
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- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resist. Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other: All Drums are required to be labeled. Langan employees do not open or move undocumented drums or unlabeled drums without proper project manager authorization.

**JOB STEPS**

**S** – Stop, what has changed?  
**T** – Think about the task  
**E** – Evaluate potential hazards  
**P** – Plan safe approach  
**S** – Start task / Stop & regroup
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<tr>
<td>24. Moving Drums</td>
<td>2. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 3. Back Strains</td>
<td>2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery, or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. 3. Use proper lifting techniques/Use wheeled transport</td>
</tr>
<tr>
<td>25. All activities</td>
<td>31. Slips/ Trips/ Falls 32. Hand injuries, cuts, or lacerations during manual handling of materials 33. Foot injuries 34. Back injuries 35. Traffic 36. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 37. High Noise levels 38. Overhead hazards 39. Heat Stress/ Cold Stress 40. Eye Injuries</td>
<td>37. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 38. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 39. Wear Langan approved safety shoes 40. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 41. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area 42. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 43. Wear hearing protection 44. Wear hard hat / Avoid areas were overhead hazards exist. 45. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 46. Wear safety glasses</td>
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<tr>
<td>26. Move equipment to work site</td>
<td>19. Back strain when lifting equipment</td>
<td>13. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle</td>
</tr>
<tr>
<td>20. Slips/ Trips/ Falls while moving equipment</td>
<td>21. Traffic (if applicable)</td>
<td>14. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift</td>
</tr>
<tr>
<td>22. Pinched fingers or running over toes during geoprobe set-up</td>
<td>23. Overturn drilling rig while transporting to loading dock on flat-bed tow truck</td>
<td>15. Wear high visibility safety vests or clothing / Exercise caution</td>
</tr>
<tr>
<td>27. Calibration of monitoring equipment</td>
<td>10. Skin or eye contact with calibration chemicals</td>
<td>8. Wear proper PPE (safety glasses/ goggles)</td>
</tr>
<tr>
<td>29. Advance geoprobe rods below ground surface to desired depth</td>
<td>10. Geoprobe rig movement</td>
<td>8. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe</td>
</tr>
<tr>
<td>30. Remove and open acetate liner</td>
<td>4. Underground utilities</td>
<td>4. Clean all subsurface soil borings to a minimum of 5 feet below grade</td>
</tr>
<tr>
<td></td>
<td>5. High noise levels</td>
<td>5. Wear proper PPE (hearing protection)</td>
</tr>
<tr>
<td></td>
<td>41. Pinched fingers while removing macrocore</td>
<td>1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
</tbody>
</table>

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

- Safety Shoes
- Long Sleeves
- Safety Vest (Class 2)
- Hard Hat
- Hearing Protection
- Safety Glasses
- Safety Goggles
- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resist. Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other: Half-face respirator, dust cartridges, PID (if applicable)
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Remove and open acetate liner (cont’d)</td>
<td>42. Cuts/lacerations when cutting acetate liner open 43. Exposure to hazardous vapors 44. Skin contact with contaminated soil</td>
<td>3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 4. Wear proper PPE (nitrile gloves)</td>
</tr>
</tbody>
</table>
| 31. Sample Collections  
a) Monitor parameters  
b) Prepare sample containers and labels | 1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain while transporting full coolers 4. Internal exposure to contaminants and metals through inhalation of dust 5. Slips/ Trips/ Falls | 1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage 3. Use proper lifting techniques / Do not lift heavy loads without assistance 4. Avoid creating dust / If necessary, wear a half mask respirator with applicable dust cartridge / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 5. Be alert / Follow good housekeeping procedures |
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| 8. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!) | 1. Back, arm or shoulder strain from moving drums  
2. Pinch fingers/hand in drum cart when moving drums  
3. Pinch fingers/hand when operating lift-gate on vehicle  
4. Contact with potentially contaminated groundwater when moving improperly sealed drums  
5. Slips when moving drums  
6. Drop drum on feet/ toes | 47. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance  
48. Wear proper PPE (cut-resistant or leather gloves)  
49. Wear proper PPE (cut-resistant or leather gloves)  
50. Wear proper PPE (nitrile gloves underneath work gloves)  
51. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions  
52. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum |
| 9. All activities | 1. Slips/ Trips/ Falls  
2. Hand injuries, cuts, or lacerations during manual handling of materials  
3. Foot injuries  
4. Back injuries  
5. Traffic  
6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)  
7. High Noise levels  
8. Overhead hazards  
9. Heat Stress/ Cold Stress | 1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards  
2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves  
3. Wear Langan approved safety shoes  
4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible  
5. Wear high visibility clothing & vest / Use cones or signs to designate work area  
6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellent / Use bug spray when needed  
7. Wear hearing protection  
8. Wear hard hat / Avoid areas were overhead hazards exist.  
9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress  
10. Wear safety glasses |

Additional items.

Additional Items identified while in the field.

(Delete row if not needed.)

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Sign Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by:</td>
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<th>Reviewed by:</th>
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A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work “TAKE 5” and conduct a Last Minute Risk Assessment.

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<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>33. Transport equipment to work area</td>
<td>24. Back/strain</td>
<td>18. Use proper lifting techniques/Use wheeled transport</td>
</tr>
<tr>
<td></td>
<td>25. Slip/Trip/Falls</td>
<td>19. Minimize distance to work area/unobstructed path to work area/ follow good housekeeping procedures</td>
</tr>
<tr>
<td></td>
<td>26. Traffic</td>
<td>20. Wear proper PPE (high visibility vest or clothing)</td>
</tr>
<tr>
<td></td>
<td>27. Cuts/abrasions/contusions from equipment</td>
<td>21. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)</td>
</tr>
<tr>
<td>34. Supervision of subcontractor and all other activities</td>
<td>12. Slip/Trips/Falls</td>
<td>10. Be aware of potential trip hazards/follow good housekeeping procedures/mark significant below-grade hazards (i.e. holes, trenches, wires, ropes) with safety cones or spray paint.</td>
</tr>
<tr>
<td></td>
<td>13. Hand injuries</td>
<td>11. Wear proper PPE (leather gloves)/watch wear you place your hands/inspect material or equipment for jagged, rough, or slippery surfaces/watch for pinch points/wipe off slippery, wet, or dirty items prior to handling.</td>
</tr>
<tr>
<td></td>
<td>14. Foot injuries</td>
<td>12. Wear proper PPE (Langan approved safety shoes)/ Be aware of uneven terrain)</td>
</tr>
<tr>
<td></td>
<td>16. Traffic</td>
<td>14. Wear proper PPE (high-visibility shirts and vests)/ use cones if appropriate/ notify equipment operators of work area.</td>
</tr>
<tr>
<td></td>
<td>17. Wildlife</td>
<td>15. Be aware of surroundings at all times for the presence of wildlife.</td>
</tr>
<tr>
<td></td>
<td>a. Wildlife</td>
<td>a. Do not approach stray animals</td>
</tr>
<tr>
<td></td>
<td>b. Mice/rats</td>
<td>b. Carry animal repellent/ use if situation arises.</td>
</tr>
<tr>
<td></td>
<td>c. Vectors (i.e. mosquitoes, bees, etc.)</td>
<td>c. Use bug spray when needed</td>
</tr>
<tr>
<td></td>
<td>7. Heat/Cold Stress</td>
<td>7. Wear proper attire for weather conditions (sunscreen, protective clothing in</td>
</tr>
</tbody>
</table>

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

- Safety Shoes
- Long Sleeves
- Safety Vest (Class 2)
- Hard Hat
- Hearing Protection
- Safety Glasses
- Safety Goggles
- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resistant Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other:

Job Safety Analysis (JSA)
Health and Safety
S – Stop, what has changed?
I – Think about the task
E – Evaluate potential hazards
P – Plan safe approach
S – Start task / Stop & regroup

LANGAN

JSA Title: Geophysical Investigation
JSA Number: JSA023-01
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</thead>
<tbody>
<tr>
<td>35. All activities</td>
<td>45. Slips/ Trips/ Falls</td>
<td>sunlight or layer clothing in cold weather)/ drink plenty of fluids/ take regular breaks.</td>
</tr>
<tr>
<td></td>
<td>46. Hand injuries, cuts, or lacerations during manual handling of materials</td>
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<tr>
<td></td>
<td>47. Foot injuries</td>
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<tr>
<td></td>
<td>48. Back injuries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>49. Traffic</td>
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</tr>
<tr>
<td></td>
<td>50. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)</td>
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<td>51. High Noise levels</td>
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<td></td>
<td>52. Overhead hazards</td>
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</tr>
<tr>
<td></td>
<td>53. Heat Stress/ Cold Stress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>54. Eye Injuries</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>53. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55. Wear Langan approved safety shoes</td>
</tr>
<tr>
<td></td>
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<td>56. Use proper lifting techniques / Consider load location, task repetition, and load weight when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
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<tr>
<td></td>
<td></td>
<td>57. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>58. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>59. Wear proper hearing protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60. Wear hard hat / Avoid areas were overhead hazards exist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>61. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>62. Wear safety glasses</td>
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<td>Additional Items</td>
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<td></td>
<td>Additional Items identified while in the field.</td>
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<td>(Delete row if not needed.)</td>
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</tr>
</tbody>
</table>

Print Name | Sign Name | Date
Prepared by:

Reviewed by:
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventative/corrective actions. Prior to the start of any work “TAKE 5” and conduct a Last Minute Risk Assessment.

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<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>36. Transport equipment to work site</td>
<td>28. Back injuries</td>
<td>22. Use proper lifting techniques/ Use wheeled transport/ Get assistance when need with moving equipment/ Minimize distance from vehicle</td>
</tr>
<tr>
<td></td>
<td>29. Slips/Trips/Falls</td>
<td>23. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures.</td>
</tr>
<tr>
<td></td>
<td>30. Traffic</td>
<td>24. Wear proper PPE (High Visibility vest and clothing)/ Exercise caution (stay alert-stay alive)</td>
</tr>
<tr>
<td></td>
<td>31. Hand injuries</td>
<td>25. Wear proper PPE (leather gloves)/ Keep finger and hands clear of pinch points.</td>
</tr>
<tr>
<td>37. Mark area for drilling</td>
<td>18. Slips/Trips/Falls</td>
<td>16. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures</td>
</tr>
<tr>
<td>38. Drill sampling points with hammer drill</td>
<td>11. Eye injuries</td>
<td>9. Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td></td>
<td>12. Dust exposure</td>
<td>10. Wear proper PPE (dust mask)</td>
</tr>
<tr>
<td></td>
<td>13. Hand injuries</td>
<td>11. Wear proper PPE (leather gloves)/ Keep hands and fingers out of pinch points/ Avoid drill catching on ground and twisting wrist or hand/ Release drill grip if drill becomes caught/ Ensure drill is unplugged prior to inserting bit.</td>
</tr>
<tr>
<td></td>
<td>14. Catch items (clothing)</td>
<td>12. Tie up or tuck-in all loose clothing/ Maintain distance from drill</td>
</tr>
<tr>
<td></td>
<td>15. Electric shock</td>
<td>13. Inspect power cable for cuts or nicks before use/ Use GFCI outlet on power cord/ Do not use in wet conditions</td>
</tr>
<tr>
<td></td>
<td>16. Chemical atmosphere hazard (vapor)</td>
<td>14. Monitor air, vapors with Photo-ionization detector (PID)</td>
</tr>
<tr>
<td></td>
<td>17. Slips/Trips/Falls</td>
<td></td>
</tr>
</tbody>
</table>

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):
- Safety Shoes
- Long Sleeves
- Safety Vest (Class 2)
- Hard Hat
- Hearing Protection
- Safety Glasses
- Safety Goggles
- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resist. Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other: Tyvek Sleeves

S - Stop, what has changed?
T - Think about the task
E - Evaluate potential hazards
P - Plan safe approach
S - Start task / Stop & regroup
<table>
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<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Minimize distance from vehicle/</td>
<td>1. Monitor air, vapors with Photo-ionization</td>
<td></td>
</tr>
<tr>
<td>Have unobstructed pathway to vehicle</td>
<td>detector (PID)/ Keep face away from opening</td>
<td></td>
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<tr>
<td>and collection points/ Mark tripping</td>
<td>of hole while collecting measurements</td>
<td></td>
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<tr>
<td>hazards with spray paint, cones, or</td>
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<tr>
<td>caution tape/ Observe good housekeeping</td>
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<tr>
<td>procedures</td>
<td></td>
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</tr>
<tr>
<td>39. Measure vapor content and depth</td>
<td>1. Chemical atmosphere hazard (vapors)</td>
<td>1. Monitor air, vapors with Photo-</td>
</tr>
<tr>
<td>to bottom of hole</td>
<td></td>
<td>ionization detector (PID)/ Keep</td>
</tr>
<tr>
<td>40. Set-up of shroud and sampling</td>
<td>1. Hand injuries</td>
<td>face away from opening of hole</td>
</tr>
<tr>
<td>canister system</td>
<td>2. Chemical atmosphere hazard (vapors)</td>
<td>while collecting measurements</td>
</tr>
<tr>
<td>41. Purge soil gas</td>
<td>3. Slips/Trips/Falls</td>
<td>1. Wear proper PPE (leather gloves,</td>
</tr>
<tr>
<td>42. Sample collection (opening</td>
<td></td>
<td>nitrile gloves)/ Keep fingers</td>
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<tr>
<td>and closing valves)</td>
<td></td>
<td>away from pinch points when</td>
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<tr>
<td>43. Sealing sampling holes</td>
<td></td>
<td>installing pump/ Do not use open</td>
</tr>
<tr>
<td>44. All activities</td>
<td></td>
<td>blades, use tubing cutter</td>
</tr>
<tr>
<td>55. Hand injuries, cuts, or lacerations</td>
<td></td>
<td>2. Monitor air, vapors with Photo-</td>
</tr>
<tr>
<td>during manual handling of materials</td>
<td></td>
<td>ionization detector (PID)/ Keep</td>
</tr>
<tr>
<td>56. Foot injuries</td>
<td></td>
<td>face away from opening of hole</td>
</tr>
<tr>
<td>57. Back injuries</td>
<td></td>
<td>while collecting measurements</td>
</tr>
<tr>
<td>58. Traffic</td>
<td></td>
<td>3. Minimize distance from vehicle/</td>
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<td>59. Wildlife: Stray animals, Mice/rats,</td>
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<td>Have unobstructed pathway to</td>
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<td>Vectors (i.e. mosquitoes, bees, etc.)</td>
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<td>vehicle and collection points/</td>
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<tr>
<td>60. High Noise levels</td>
<td></td>
<td>Mark tripping hazards with spray</td>
</tr>
<tr>
<td>61. Overhead hazards</td>
<td></td>
<td>paint, cones, or caution tape/</td>
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<tr>
<td>62. Heat or cold injuries</td>
<td></td>
<td>Observe good housekeeping</td>
</tr>
<tr>
<td>63. Eye Injuries</td>
<td></td>
<td>procedures</td>
</tr>
<tr>
<td>64. Be aware of potential trip hazards/</td>
<td></td>
<td>Mark significant hazards</td>
</tr>
<tr>
<td>Follow good housekeeping procedures/</td>
<td></td>
<td>65. Use proper lifting techniques/</td>
</tr>
<tr>
<td>Mark significant hazards</td>
<td></td>
<td>Consider load location, task</td>
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<tr>
<td>Inspect for jagged/sharp edges, and</td>
<td></td>
<td>repetition, and load weigh when</td>
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<tr>
<td>rough or slippery surfaces/ Keep</td>
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<td>evaluating what is safe or unsafe</td>
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<tr>
<td>fingers away from pinch points/ Wipe</td>
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<td>to lift/ Obtain assistance when</td>
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<td>off greasy, wet, slippery or dirty</td>
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<td>possible</td>
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<td>objects before handling/ Wear leather/</td>
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<td>66. Wear high visibility clothing &amp;</td>
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<tr>
<td>cut-resistant gloves</td>
<td></td>
<td>vest/ Use cones or signs to</td>
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<tr>
<td>Wear proper PPE (Langan approved safety</td>
<td></td>
<td>designate work area</td>
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<td>shoes)</td>
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<td>67. Be aware of surroundings at</td>
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<tr>
<td>66. Use proper lifting techniques/</td>
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<td>all times, including the presence</td>
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<tr>
<td>Consider load location, task repetition,</td>
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<td>of wildlife/ Do not approach</td>
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<tr>
<td>and load weigh when evaluating what is</td>
<td></td>
<td>stray animals/ Carry and use</td>
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<tr>
<td>safe or unsafe to lift/ Obtain</td>
<td></td>
<td>animal repellent when needed/ Use</td>
</tr>
<tr>
<td>assistance when possible</td>
<td></td>
<td>bug spray when needed</td>
</tr>
<tr>
<td>68. Wear hearing protection</td>
<td></td>
<td>69. Wear hard hat/ Avoid areas</td>
</tr>
<tr>
<td>70. Wear proper attire for weather</td>
<td></td>
<td>were overhead hazards exist.</td>
</tr>
<tr>
<td>conditions (sunscreen or protective</td>
<td></td>
<td>71. Wear safety glasses</td>
</tr>
<tr>
<td>clothing in sunlight, layers for cold</td>
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<tr>
<td>weather)/ Drink plenty of fluids to</td>
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<tr>
<td>avoid dehydration/ Takes breaks as</td>
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<tr>
<td>necessary to avoid heat/cold stress</td>
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<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>PREVENTATIVE / CORRECTIVE ACTION</td>
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<tr>
<td>Additional items.</td>
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<td></td>
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<tr>
<td><strong>Reviewed by:</strong></td>
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</table>
**Job Safety Analysis (JSA)**

**Health and Safety**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventative/corrective actions. Prior to the start of any work “TAKE 5” and conduct a Last Minute Risk Assessment.

### PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

<table>
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<tr>
<th>☒ Safety Shoes</th>
<th>☒ Long Sleeves</th>
<th>☒ Safety Vest (Class 2)</th>
<th>☒ Hard Hat</th>
<th>☒ Hearing Protection</th>
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</thead>
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<tr>
<td>☒ Safety Glasses</td>
<td>☐ Safety Goggles</td>
<td>☐ Face Shield</td>
<td>☒ Nitrile Gloves</td>
<td>☐ PVC Gloves</td>
</tr>
<tr>
<td>☒ Leather Gloves</td>
<td>☐ Cut Resist. Gloves</td>
<td>☐ Fall Protection</td>
<td>☐ Fire Resistant Clothing</td>
<td>☐ Rubber Boots</td>
</tr>
<tr>
<td>☐ Insect/Animal Repellent</td>
<td>☐ Ivy Blocker/Cleaner</td>
<td>☒ Traffic Cones/Signs</td>
<td>☐ Life Vest/Jacket</td>
<td></td>
</tr>
<tr>
<td>☐ Other: PID, Respiratory Protection (if necessary)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### JOB STEPS

<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>45. Building walkthrough and background contaminant removal</td>
<td>32. Slips / Trips / Falls 33. Exposure to substances / vapors during removal</td>
<td>6. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint 7. Monitor indoor air concentrations with a PID / Wear proper PPE (nitrile gloves) / Wear proper respiratory protection if necessary</td>
</tr>
<tr>
<td>47. Mark out areas for indoor air sampling</td>
<td>19. Slips / Trips / Falls</td>
<td>3. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint</td>
</tr>
<tr>
<td>48. Set-up canisters and begin indoor air sampling</td>
<td>18. Dropping crates or canisters 19. Pinch hazard</td>
<td>5. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 6. Wear proper PPE (leather gloves)</td>
</tr>
<tr>
<td>49. Sample collection</td>
<td>1. Dropping crates or canisters 2. Pinched fingers from opening valves</td>
<td>1. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 2. Wear proper PPE (leather gloves) / Keep fingers away from pinch points</td>
</tr>
<tr>
<td>50. Pack up equipment</td>
<td>1. Back strain</td>
<td>1. Use proper lifting techniques / Use wheeled transport</td>
</tr>
<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>PREVENTATIVE / CORRECTIVE ACTION</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>2.</td>
<td>Slips/ Trips/ Falls</td>
<td>2. Be aware of potential trip hazards / Follow good housekeeping procedures / Minimize distance to vehicle</td>
</tr>
<tr>
<td>3.</td>
<td>Traffic</td>
<td>3. Wear proper PPE (safety vest)</td>
</tr>
<tr>
<td>51.</td>
<td>All activities</td>
<td>72. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant hazards</td>
</tr>
<tr>
<td>65.</td>
<td>Slips/ Trips/ Falls</td>
<td>73. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves</td>
</tr>
<tr>
<td>66.</td>
<td>Hand injuries, cuts, or lacerations during manual handling of materials</td>
<td>74. Wear Langan approved safety shoes</td>
</tr>
<tr>
<td>67.</td>
<td>Foot injuries</td>
<td>75. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
</tr>
<tr>
<td>68.</td>
<td>Back injuries</td>
<td>76. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
</tr>
<tr>
<td>69.</td>
<td>Traffic</td>
<td>77. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed</td>
</tr>
<tr>
<td>70.</td>
<td>Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)</td>
<td>78. Wear hearing protection</td>
</tr>
<tr>
<td>71.</td>
<td>High Noise levels</td>
<td>79. Wear hard hat / Avoid areas where overhead hazards exist.</td>
</tr>
<tr>
<td>72.</td>
<td>Overhead hazards</td>
<td>80. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
<tr>
<td>73.</td>
<td>Heat Stress/ Cold Stress</td>
<td>81. Wear safety glasses</td>
</tr>
<tr>
<td>74.</td>
<td>Eye Injuries</td>
<td></td>
</tr>
</tbody>
</table>

Additional items.

Additional Items identified while in the field.

(Delete row if not needed.)

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**Job Safety Analysis (JSA)**

**Health and Safety**

**JSA Title:** Hammer Drill  
**JSA Number:** JSA049

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work “TAKE 5” and conduct a Last Minute Risk Assessment.

### PERSONAL PROTECTIVE EQUIPMENT

- **Safety Shoes**
- **Long Sleeves**
- **Safety Vest (Class 2)**
- **Hard Hat**
- **Hearing Protection**
- **Safety Glasses**
- **Safety Goggles**
- **Face Shield**
- **Nitrile Gloves**
- **PVC Gloves**
- **Leather Gloves**
- **Cut Resist. Gloves**
- **Fall Protection**
- **Fire Resistant Clothing**
- **Rubber Boots**
- **Insect/Animal Repellent**
- **Ivy Blocker/Cleaner**
- **Traffic Cones/Signs**
- **Life Vest/Jacket**
- **Other:**

### JOB STEPS

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<tr>
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<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
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<tbody>
<tr>
<td>52. Transport equipment to work area</td>
<td>34. Back Strain</td>
<td>8. Use proper lifting techniques / Use wheeled transport</td>
</tr>
<tr>
<td></td>
<td>35. Slips/ Trips/ Falls</td>
<td>9. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures</td>
</tr>
<tr>
<td></td>
<td>36. Traffic</td>
<td>10. Wear proper PPE (high visibility vest or clothing)</td>
</tr>
<tr>
<td></td>
<td>37. Cuts/abrasions from equipment</td>
<td>11. Wear proper PPE (leather gloves, long sleeves)</td>
</tr>
<tr>
<td></td>
<td>38. Contusions from dropped equipment</td>
<td>12. Wear proper PPE (safety shoes)</td>
</tr>
<tr>
<td>53. Electrical Connection</td>
<td>20. Inspect electrical cord to drill</td>
<td>4. Check the plug, insure all connections are in place, check cord for frayed sections. If plug or cord are worn, do not use equipment until repaired</td>
</tr>
<tr>
<td></td>
<td>21. Inspect hammer drill</td>
<td>5. Inspect chuck for proper grasping and holding of bit, check that plastic housing is not cracked or missing pieces. Do not use if chuck does not work properly or housing is compromised.</td>
</tr>
<tr>
<td></td>
<td>22. Inspect extension cord</td>
<td>6. Inspect extension cord, if worn or stripped pull from service and replace</td>
</tr>
<tr>
<td></td>
<td>23. Test GFCI</td>
<td>7. Test GFCI, replace if GFCI fails</td>
</tr>
<tr>
<td>54. Drill Bit</td>
<td>1. Inspect drill bit</td>
<td>1. Replace if worn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Wear proper PPE (leather gloves) when installing and removing drill bit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Ensure equipment is unplugged from electrical power when removing and installing drill bit.</td>
</tr>
<tr>
<td>55. Use of Hammer Drill</td>
<td>1. Hazards associated with using hammer drill, flying objects, heavy equipment, ground level hazards and dust</td>
<td>1. Maintain a safe distance from other site operations / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest, ear protection and leather gloves)</td>
</tr>
<tr>
<td></td>
<td>2. Slips/ Trips/ Falls</td>
<td>2. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark extension chord pathway with safety cones</td>
</tr>
<tr>
<td></td>
<td>3. Hazards associated drilling into concrete slab</td>
<td>3. Do not push hammer drill during use.</td>
</tr>
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<td>JOB STEPS</td>
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</tr>
<tr>
<td>56. All activities</td>
<td>75. Slips/ Trips/ Falls 76. Hand injuries, cuts, or lacerations during manual handling of materials 77. Foot injuries 78. Back injuries 79. Traffic 80. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 81. High Noise levels 82. Overhead hazards 83. Heat Stress/ Cold Stress 84. Eye Injuries</td>
<td>82. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant hazards 83. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 84. Wear Langan approved safety shoes 85. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 86. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area 87. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 88. Wear hearing protection 89. Wear hard hat / Avoid areas were overhead hazards exist. 90. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 91. Wear safety glasses</td>
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<tr>
<td>4. All activities (cont’d)</td>
<td></td>
<td></td>
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<tr>
<td>Additional items.</td>
<td></td>
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<tr>
<td>57. Transport equipment to work area</td>
<td>6. Back Strain</td>
<td>6. Use proper lifting techniques / Use wheeled transport</td>
</tr>
<tr>
<td>7. Slips/Trips/Falls</td>
<td>7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures</td>
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<td>9. Cuts/abrasions from equipment</td>
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<td>☒ Leather Gloves</td>
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<tr>
<td>☐ Insect/Animal Repellent</td>
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<tr>
<td>☐ Other: Tyvek sleeves, Dermal Protection, PID</td>
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<tbody>
<tr>
<td>58. Remove well cover</td>
<td>24. Scrape knuckles/hand</td>
<td>8. Wear proper PPE (leather gloves)</td>
</tr>
<tr>
<td>25. Strain wrist/bruise palm</td>
<td>9. Using a hammer, tap the end of the wrench to loosen grip of bolts</td>
<td></td>
</tr>
<tr>
<td>26. Pinch fingers or hand</td>
<td>10. Wear proper PPE (leather gloves)</td>
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<tr>
<td>59. Remove well cap and lock</td>
<td>20. Well can pops from pressure</td>
<td>7. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td>21. Exposure to hazardous substances through inhalation or dermal exposure</td>
<td>8. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves)</td>
<td></td>
</tr>
<tr>
<td>22. Scrape knuckles/hand</td>
<td>9. Wear proper PPE (leather gloves)</td>
<td></td>
</tr>
<tr>
<td>23. Strain wrist/bruise palm</td>
<td>10. Using hammer, tap the end of the wrench to loosen grip</td>
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<tr>
<td>60. Measure head-space vapor levels</td>
<td>3. Exposure to hazardous substances through inhalation</td>
<td>3. Do not place face over well when collecting measurement</td>
</tr>
</tbody>
</table>

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<tr>
<td>61. Remove dedicated tubing (if necessary)</td>
<td>4. Exposure to hazardous substances through inhalation or dermal exposure</td>
<td>4. Wear proper PPE (nitrile gloves, Tyvek sleeves)</td>
</tr>
<tr>
<td>5. Tubing swings around after removal</td>
<td>5. Wear proper PPE (safety glasses)</td>
<td></td>
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<tr>
<td>62. Set-up plastic sheeting for work site around the well</td>
<td>1. Lacerations when cutting plastic sheeting</td>
<td>1. Use scissors to cut plastic sheeting / Cut motions should always be away from body and body parts</td>
</tr>
<tr>
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<td>PREVENTATIVE / CORRECTIVE ACTION</td>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 63. Measure depth to water | 1. Exposure to hazardous substances through inhalation or dermal exposure  
2. Pinch fingers or hand in water level instrument                                                                                                                      | 1. Wear proper PPE (nitrile gloves)  
2. Wear proper PPE (leather gloves)                                                                                                                              |
| 64. Calibrate monitoring equipment | 1. Skin or eye contact with calibration chemicals  
2. Pinch fingers or hand in monitoring equipment                                                                                                                                      | 1. Wear proper PPE (safety glasses, nitrile gloves)  
2. Wear proper PPE (leather gloves) / Avoid pinch points                                                                                                           |
| 65. Install sampling pump in well | 1. Hand injuries during installation of pump  
2. Lacerations when cutting tubing  
3. Back strain during installation of pump  
4. Physical hazards associated with manual lifting of heavy equipment  
5. Back strain from starting generator  
6. Burns from hot exhaust from generator  
7. Electrical shock from improper use of generator and pump  
8. Contaminated water spray from loose connections                                                                                                                   | 1. Wear proper PPE (leather gloves, nitrile gloves)  
2. Use safety tubing cutter  
3. Use proper lifting techniques  
4. Use proper lifting techniques / Use wheeled transport for heavy equipment  
5. Use arm when starting generator / Do not over-strain if generator does not start  
6. Do not touch generator near exhaust / Use proper handle to carry / Allow generator to cool down before moving  
7. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord  
8. Check all tubing connections to ensure they are tight and secure                                                                                                    |
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| 10. Purge water | 1. Contact with potentially contaminated groundwater  
2. Back strain from lifting buckets of water  
3. Tripping potential on sample discharge lines and pump electric line | 1. Wear proper PPE (safety glasses, nitrile gloves)  
2. Use proper lifting techniques / Use wheeled transport  
3. Organize discharge of electric line to keep out of way as much as possible / Mark potential tripping hazards with caution tape or safety cones |
| 11. Sample water collection | 1. Contact with potentially contaminated groundwater through dermal exposure  
2. Contact with and burns from acid used for sample preservation  
3. Tripping potential on sample discharge lines and pump electric line  
4. Lacerations from broken sample bottles  
5. Back strain when transporting coolers full of collected samples  
6. Slips/ Trips/ Falls | 1. Wear proper PPE (safety glasses, nitrile gloves)  
2. Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection  
3. Organize line to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones  
4. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible  
5. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle  
6. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift |
| 12. Remove pump and pack up equipment | 1. Back strain when removing pump or lifting heavy equipment | 1. Use proper lifting technique / Use wheeled transport for heavy equipment |
| 13. Replace well cap and lock | 1. Scrape fingers/hand  
2. Strain wrist/bruise palm | 1. Wear proper PPE (leather gloves)  
2. Using hammer, tap the end of the well cap to tighten grip |
| 14. Replace well cover | 1. Scrape knuckles/hand  
2. Strain wrist/bruise palm  
3. Pinch fingers or hand | 1. Wear proper PPE (leather gloves)  
2. Using hammer, tap the end of the wrench to tighten the grip of the bolts  
3. Wear proper PPE (leather gloves) |
| 15. Transport drums to disposal staging location | 1. Back, arm or shoulder strain from moving drums  
2. Pinch hazard  
3. Contact with potentially contaminated groundwater when moving improperly sealed drums  
4. Slips/ Trips/ Falls when moving drum  
5. Drop drum on feet/toes | 1. Use drum cart for moving drums / Use proper lifting techniques / Obtain assistance, if needed  
2. Wear proper PPE (leather gloves)  
3. Wear proper PPE (nitrile gloves under leather gloves) / Properly seal drum to prevent leak  
4. Ensure route to move drum to storage space is dry and free from obstructions  
5. Wear proper PPE (safety shoes) |
| 16. Place used PPE in designated disposal drum | 1. Pressure build-up inside drum  
2. Pinch hazard | 1. Remove cap from bung hole in drum to relieve pressure  
2. Wear proper PPE (leather gloves) |
| 17. Decontaminate equipment | 1. Splashing water/soap from decontamination  
2. Contact with potentially contaminated groundwater through dermal exposure  
3. Electrical shock from broken electric cords | 1. Wear proper PPE (safety glasses)  
2. Wear proper PPE (safety glasses, dermal protection)  
3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord |
| 18. All activities | 85. Slips/ Trips/ Falls  
86. Hand injuries, cuts, or lacerations during manual handling of materials  
87. Foot injuries  
88. Back injuries  
89. Traffic  
90. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) | 92. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant hazards  
93. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves  
94. Wear Langan approved safety shoes |
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<tr>
<td>91.</td>
<td>High Noise levels</td>
<td>95. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
</tr>
<tr>
<td>92.</td>
<td>Overhead hazards</td>
<td>96. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
</tr>
<tr>
<td>93.</td>
<td>Heat Stress/ Cold Stress</td>
<td>97. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed</td>
</tr>
<tr>
<td>94.</td>
<td>Eye Injuries</td>
<td>98. Wear hearing protection</td>
</tr>
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<td></td>
<td></td>
<td>99. Wear hard hat / Avoid areas were overhead hazards exist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>101. Wear safety glasses</td>
</tr>
</tbody>
</table>

Additional items.

Additional Items identified while in the field.

(Delete row if not needed.)

Print Name  | Sign Name  | Date |
-----------|------------|------|
Prepared by: |            |      |

Reviewed by: |            |      |
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventative/corrective actions. Prior to the start of any work “TAKE 5” and conduct a Last Minute Risk Assessment.

### PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

<table>
<thead>
<tr>
<th>Item</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Shoes</td>
<td>☑</td>
</tr>
<tr>
<td>Long Sleeves</td>
<td>☑</td>
</tr>
<tr>
<td>Safety Vest (Class 2)</td>
<td>☑</td>
</tr>
<tr>
<td>Hard Hat</td>
<td>☑</td>
</tr>
<tr>
<td>Hearing Protection</td>
<td>☑</td>
</tr>
<tr>
<td>Safety Glasses</td>
<td>☐</td>
</tr>
<tr>
<td>Safety Goggles</td>
<td>☐</td>
</tr>
<tr>
<td>Face Shield</td>
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</tr>
<tr>
<td>Nitrile Gloves</td>
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<tr>
<td>PVC Gloves</td>
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<tr>
<td>Leather Gloves</td>
<td>☐</td>
</tr>
<tr>
<td>Cut Resist. Gloves</td>
<td>☐</td>
</tr>
<tr>
<td>Fall Protection</td>
<td>☐</td>
</tr>
<tr>
<td>Fire Resistant Clothing</td>
<td>☐</td>
</tr>
<tr>
<td>Rubber Boots</td>
<td>☐</td>
</tr>
<tr>
<td>Insect/Animal Repellent</td>
<td>☐</td>
</tr>
<tr>
<td>Ivy Blocker/Cleaner</td>
<td>☐</td>
</tr>
<tr>
<td>Traffic Cones/Signs</td>
<td>☐</td>
</tr>
<tr>
<td>Life Vest/Jacket</td>
<td>☐</td>
</tr>
<tr>
<td>Other: PID, Tyvek sleeves</td>
<td>☑</td>
</tr>
</tbody>
</table>

### JOB STEPS | POTENTIAL HAZARDS | PREVENTATIVE / CORRECTIVE ACTION

66. Move equipment to work site
   39. Back strain when lifting equipment
   40. Slips/ Trips/ Falls while moving equipment
       41. Traffic (if applicable)
       42. Pinched fingers or running over toes during geoprobe set-up
       43. Overturn drilling rig while transporting to loading dock on flat-bed tow truck
       26. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle
       27. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift
       28. Wear high visibility safety vests or clothing / Exercise caution
       29. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times
       30. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck / All unnecessary personnel should stay away from the flat-bed truck during moving activities

67. Calibration of monitoring equipment
   27. Skin or eye contact with calibration chemicals
   28. Pinch fingers in monitoring equipment
       17. Wear proper PPE (safety glasses/ goggles)
       18. Wear proper PPE (leather gloves)

19. Set-up geoprobe rig
   24. Geoprobe rig movement
       16. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe

20. Advance geoprobe rods below ground surface to desired depth
   6. Underground utilities
   7. High noise levels
       9. Clean all subsurface soil borings to a minimum of 5 feet below grade
       10. Wear proper PPE (hearing protection)
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>Remove and open acetate liner</td>
<td><strong>5.</strong> Wear proper PPE (nitrile gloves, cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>6.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>7.</strong> Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>8.</strong> Wear proper PPE (nitrile gloves)</td>
</tr>
<tr>
<td>5.</td>
<td>Remove and open acetate liner (cont’d)</td>
<td><strong>5.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>6.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<td></td>
<td><strong>7.</strong> Wear proper PPE (nitrile gloves)</td>
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<td></td>
<td><strong>8.</strong> Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td>6.</td>
<td>Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)</td>
<td><strong>5.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>6.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<td><strong>8.</strong> Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td>7.</td>
<td>Attach hollow-stem augers to the geoprobe rig; Advance augers and attach additional augers until desired depth is reached</td>
<td><strong>1.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>3.</strong> Use proper lifting techniques</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>4.</strong> Wear proper work attire (no loose clothing/strings)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>5.</strong> Properly ventilate work area</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>6.</strong> Wear proper PPE (safety shoes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>7.</strong> Wear proper PPE (hearing protection)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>8.</strong> Wear proper PPE (Tyvek sleeves, nitrile gloves)</td>
</tr>
<tr>
<td>8.</td>
<td>Install monitoring well</td>
<td><strong>1.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>3.</strong> Use proper lifting techniques</td>
</tr>
<tr>
<td>9.</td>
<td>Tremie-grout annulus space above bentonite seal</td>
<td><strong>1.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>3.</strong> Use proper lifting techniques</td>
</tr>
<tr>
<td>10.</td>
<td>Install flush-mount monitoring well pad</td>
<td><strong>1.</strong> Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<td><strong>3.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td>11.</td>
<td>Decontaminate equipment</td>
<td><strong>1.</strong> Wear proper PPE (safety glasses)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<td></td>
<td></td>
<td><strong>3.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
</tr>
<tr>
<td>12.</td>
<td>Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)</td>
<td><strong>102.</strong> Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>103.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>104.</strong> Wear proper PPE (cut-resistant or leather gloves)</td>
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<tr>
<td></td>
<td></td>
<td><strong>105.</strong> Wear proper PPE (nitrile gloves underneath work gloves)</td>
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<tr>
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<td></td>
<td><strong>106.</strong> Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>107.</strong> Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum</td>
</tr>
<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>PREVENTATIVE / CORRECTIVE ACTION</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>13. All activities</td>
<td>11. Slips/ Trips/ Falls</td>
<td>11. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant hazards</td>
</tr>
<tr>
<td>13. All activities (cont’d)</td>
<td>12. Hand injuries, cuts, or lacerations during manual handling of materials</td>
<td>12. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves</td>
</tr>
<tr>
<td></td>
<td>13. Foot injuries</td>
<td>13. Wear Langan approved safety shoes</td>
</tr>
<tr>
<td></td>
<td>14. Back injuries</td>
<td>14. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible</td>
</tr>
<tr>
<td></td>
<td>15. Traffic</td>
<td>15. Wear high visibility clothing &amp; vest / Use cones or signs to designate work area</td>
</tr>
<tr>
<td></td>
<td>16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)</td>
<td>16. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed</td>
</tr>
<tr>
<td></td>
<td>17. High Noise levels</td>
<td>17. Wear hearing protection</td>
</tr>
<tr>
<td></td>
<td>18. Overhead hazards</td>
<td>18. Wear hard hat / Avoid areas were overhead hazards exist.</td>
</tr>
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<td></td>
<td>19. Heat Stress/ Cold Stress</td>
<td>19. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
<tr>
<td></td>
<td>20. Eye Injuries</td>
<td>20. Wear safety glasses</td>
</tr>
</tbody>
</table>

Additional items.

Additional Items identified while in the field.

(Delete row if not needed.)

<table>
<thead>
<tr>
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<tbody>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Long Sleeves</td>
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</tr>
<tr>
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<tr>
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<td>☑</td>
</tr>
<tr>
<td>Other: Tyvek Sleeves</td>
<td>☑</td>
</tr>
</tbody>
</table>

### JOB STEPS | POTENTIAL HAZARDS | PREVENTATIVE / CORRECTIVE ACTION

**68. Transport equipment to work area**
- 44. Back Strains
- 45. Slips/Trips/Falls
- 46. Traffic
- 47. Cuts/Abrasions/Contusions from equipment

**Potential Hazards**

**Preventative / Corrective Action**

31. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment.
32. Minimize distance from work area/ unobstructed path to collection points and vehicle/ Follow good housekeeping procedures.
33. Wear high-visibility vest or clothing/ Exercise caution/ Use traffic cones or signage if needed.
34. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).

**69. Measure depth of water**
- 29. Exposure to hazardous substances
- 30. Pinched fingers

**Potential Hazards**

**Preventative / Corrective Action**

22. Wear proper PPE (Nitrile gloves, Safety glasses/Face shield).
23. Wear proper PPE (cut-resistant gloves).

**70. Install Tremie pipe in the monitoring well and connect to water source.**
- 27. High pressure water spray.

**Potential Hazards**

**Preventative / Corrective Action**

17. Wear proper PPE (Nitrile gloves/cut-resistant gloves).
18. Use proper lifting techniques/ Use two personnel when lowering pump greater than 80-feet.
19. Ensure all hose connections are tight and secure/ Use proper PPE (face shield and safety glasses).

**71. Install pump in to well**
- a. Connect pump to sample tubing.
- b. Lower pump to desired depth in well.
- c. Connect sample tubing to flow cell.
- d. Connect pump to power source

**Potential Hazards**

**Preventative / Corrective Action**

8. Hand injuries during pump installation and sample tubing cutting.
9. Back strain
10. Electric shock
11. Exhaust gases from generator
12. Burns from hot equipment
13. Burn proper PPE when installing pump and cutting sample tubing (Nitrile and cut-resistant gloves)/ Use tubing cutter.
12. Proper lifting techniques/ Two personnel when installing pump at depths greater than 80-feet/ Use buddy when lifting heavy loads (pump, generator)/ Use wheeled transport.
13. Ensure equipment is (LO/TO: locked out/tagged out) prior to preforming any electrical connections/ Inspect wires for frays or cuts/Ensure generator is properly grounded prior to starting.
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(generator)</td>
<td></td>
<td>14. Position generator so that exhaust is flowing away from work area. 15. Do not touch exhaust or any hot part of generator/ Allow equipment time to cool down prior to carrying/ Use proper PPE (long sleeves, leather gloves)</td>
</tr>
</tbody>
</table>
| e. Turn on power source (generator)   |                                                       | 72. Develop monitoring well  
   a. Jet water into well using Tremie pipe  
   b. Turn pump on and adjust to desired flow rate.  
   c. Surge pump up and down well to remove sediment from screen  
   d. Containerize all purge water from well.  
   99. Hand injuries  
   100. Face injuries  
   101. Contaminated spray from water  
   108. Wear proper PPE (cut-resistant gloves and nitrile gloves).  
   109. Wear proper PPE (face shield and safety glasses)/do not stand over well opening  
   110. Wear proper PPE (Face shield and safety goggles)/Tyvek over garments/ Ensure all connections are secure and tight/ Tubing outlet is contained in an overflow container. |
   2. Pinch points  
   3. Cross contamination  
   4. Slip/Trips/Falls  
   1. Use proper lifting techniques/ Use drum carts when moving drums/ use buddy system for moving of drums if needed/Move drums shortest distance needed.  
   2. Keep fingers and feet away from pinch points/ Use proper PPE (cut-resistant gloves, Langan approved safety shoes)  
   3. Use proper PPE (Nitrile gloves, Tyvek sleeves)  
   4. Ensure pathway is clear prior to moving equipment/ Mark all hazards/ Use additional person as a spotter if needed. |
| 74. Equipment pack-up                 |                                                       | 1. Back Strains  
   2. Slips/Trips/Falls  
   3. Traffic  
   4. Cuts/Abrasions/Contusions from equipment.  
   1. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment.  
   2. Minimize distance from work area/ Unobstructed path to collection points and vehicle/ Follow good housekeeping procedures.  
   3. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed.  
   111. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes). |
| 75. All activities                    |                                                       | 1. Slips/ Trips/ Falls  
   2. Hand injuries, cuts, or lacerations during manual handling of materials  
   3. Foot injuries  
   102. Back injuries  
   103. Traffic  
   104. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)  
   105. High Noise levels  
   106. Overhead hazards  
   107. Heat Stress/ Cold Stress  
   108. Eye Injuries  
   1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards  
   2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery, or dirty objects before handling / Wear leather/ cut-resistant gloves  
   3. Wear Langan approved safety shoes  
   4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible  
   5. Wear high visibility clothing & vest / Use cones or signs to designate work area  
   6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed  
   7. Wear hearing protection  
   8. Wear hard hat / Avoid areas were overhead hazards exist.  
   9. Wear proper attire for weather conditions (sunscreen or protective clothing). |
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<td>in sunlight, layers for cold weather / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress</td>
</tr>
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<td>Additional items.</td>
<td></td>
<td>10. Wear safety glasses.</td>
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<td>Additional Items identified while in the field.</td>
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### PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):

- Safety Shoes
- Long Sleeves
- Safety Vest (Class 2)
- Hard Hat
- Hearing Protection
- Safety Glasses
- Safety Goggles
- Face Shield
- Nitrile Gloves
- PVC Gloves
- Leather Gloves
- Cut Resist. Gloves
- Fall Protection
- Fire Resistant Clothing
- Rubber Boots
- Insect/Animal Repellent
- Ivy Blocker/Cleaner
- Traffic Cones/Signs
- Life Vest/Jacket
- Other: Tyvek sleeves, Dermal Protection, PID, absorbent pads

### JOB STEPS | POTENTIAL HAZARDS | PREVENTATIVE / CORRECTIVE ACTION
---|---|---
78. Remove well cap and lock | 28. Well cap pops from pressure 29. Exposure to hazardous substances through inhalation or dermal exposure 30. Scrape knuckles/hand 31. Pinch points 32. Strain write/bruise palm | 11. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses, face shield, hand protection) 12. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 13. Wear proper PPE (leather gloves) 14. Using hammer, tap the end of the wrench to loosen grip |
79. Measure head-space vapor levels | 4. Exposure to hazardous substances through inhalation | 4. Do not place face over well when collecting measurement |
80. Set-up plastic sheeting/absorbent pads | 2. Lacerations when cutting plastic sheeting/absorbent pads | 2. Use scissors to cut plastic sheeting/absorbent pads / Cut motions should always be away from body and body parts |
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>for work site around the well</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 81. Lower Bailer sleeve into well | 7. Repetitive motion injury (pulled arm/back muscles)  
8. Dehydration | 7. Take breaks while lowering bailer into well/ Use a mechanical device to lower bailer into well/ Rotate employees (take turns conducting the manual labor portion)  
8. Take breaks and drink water. |
<table>
<thead>
<tr>
<th>JOB STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Purge/Sample water/product collection</td>
<td>1. Contact with potentially contaminated groundwater or product through dermal exposure 2. Contact with and burns from acid used for sample preservation 9. Tripping potential on sampling lanyard 10. Lacerations from broken sample bottles 11. Back strain when transporting coolers full of collected samples 12. Slips/ Trips/ Falls</td>
<td>1. Wear proper PPE (safety glasses, nitrile gloves, safety shield, Tyvek) 2. Ensure sample bottle lids are secure before use and after sample collection 3. Organize lanyard to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 9. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 10. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 11. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift</td>
</tr>
<tr>
<td>9. Pack-up equipment</td>
<td>2. Back strain when removing or lifting heavy equipment</td>
<td>2. Use proper lifting technique / Use wheeled transport for heavy equipment</td>
</tr>
<tr>
<td>12. Place used PPE in designated disposal drum</td>
<td>3. Pressure build-up inside drum 4. Pinch hazard</td>
<td>3. Remove cap from bung hole in drum to relieve pressure 4. Wear proper PPE (leather gloves) 5. Product drums may require additional spill protection/electrical grounding, check local regulations</td>
</tr>
<tr>
<td>JOB STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td></td>
</tr>
</tbody>
</table>
| 14. All activities | 109. Slips/ Trips/ Falls  
110. Hand injuries, cuts, or lacerations during manual handling of materials  
111. Foot injuries  
112. Back injuries  
113. Traffic  
114. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)  
115. High Noise levels  
116. Overhead hazards  
117. Heat Stress/ Cold Stress  
118. Eye Injuries |

<table>
<thead>
<tr>
<th>PREVENTATIVE / CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| 112. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant hazards  
113. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves  
114. Wear Langan approved safety shoes  
115. Use proper lifting techniques / Consider load location, task repetition, and load weight when evaluating what is safe or unsafe to lift / Obtain assistance when possible  
116. Wear high visibility clothing & vest / Use cones or signs to designate work area  
117. Be aware of surroundings at all times, including the presence of wildlife / Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed  
118. Wear hearing protection  
119. Wear hard hat / Avoid areas were overhead hazards exist.  
120. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress  
121. Wear safety glasses |

Additional items.  
Additional Items identified while in the field.  
(Delete row if not needed.)

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Sign Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewed by:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM
LANGAN TAILGATE SAFETY BRIEFING

Date: ______________________  Time: ______________________
Leader: ______________________  Location: ______________________
Work Task: ___________________________________________________

SAFETY TOPICS (provide some detail of discussion points)

Chemical Exposure Hazards and Control: _____________________________________________________

Physical Hazards and Control: _____________________________________________________________

Air Monitoring: _____________________________________________________________

PPE: _____________________________________________________________

Communications: _____________________________________________________________

Safe Work Practices: _____________________________________________________________

Emergency Response: _____________________________________________________________

Hospital/Medical Center Location: ______________________________________________________

Phone Nos.: _____________________________________________________________

Other: _____________________________________________________________

FOR FOLLOW-UP (the issues, responsibilities, due dates, etc.)

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

ATTENDEES

<table>
<thead>
<tr>
<th>PRINT NAME</th>
<th>COMPANY</th>
<th>SIGNATURE</th>
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<tbody>
<tr>
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</tbody>
</table>
ATTACHMENT I

THE CITY OF NEW YORK
EXECUTIVE ORDER
NO. 74
Langan employees and their direct hire contractors will comply with all provisions of the New York City Executive Order No. 74 as signed by the Mayor on July 31, 2021. Specifically, effective August 2, 2021

- Will don face masks while on-site at all times; and
- Provide proof upon demand of full vaccination status.

A copy of the New York City Executive Order No. 74 is provided on the following pages.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: Biphenyl

Product Number: W312908
Brand: Aldrich
Index-No.: 601-042-00-8

CAS-No.: 92-52-4

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word: Warning

Hazard statement(s)
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
Avoid release to the environment.
Wear protective gloves/ eye protection/ face protection.
IF ON SKIN: Wash with plenty of soap and water.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin irritation occurs: Get medical advice/ attention.
If eye irritation persists: Get medical advice/ attention.
Take off contaminated clothing and wash before reuse.
Collect spillage.
Store in a well-ventilated place. Keep container tightly closed.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula: C_{12}H_{10}
Molecular weight: 154.21 g/mol
CAS-No.: 92-52-4
EC-No.: 202-163-5
Index-No.: 601-042-00-8

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biphenyl</td>
<td>Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H315, H319, H335, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biphenyl</td>
<td>92-52-4</td>
<td>TWA</td>
<td>0.2 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td></td>
<td>0.200000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pulmonary function
<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>0.2 ppm</th>
<th>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Table Z-1 Limits for Air Contaminants**

The value in mg/m³ is approximate.

<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>0.200000 ppm</th>
<th>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1.000000 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**USA. NIOSH Recommended Exposure Limits**

<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>0.200000 ppm</th>
<th>USA. NIOSH Recommended Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1.000000 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

8.2 Exposure controls

**Appropriate engineering controls**

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

- **Eye/face protection**
  
  Safety glasses with side-shields conforming to EN166. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

- **Skin protection**
  
  Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

  
  **Full contact**
  
  Material: butyl-rubber
  Minimum layer thickness: 0.3 mm
  Break through time: 480 min
  Material tested: Butoject® (KCL 897 / Aldrich Z677647, Size M)

  **Splash contact**
  
  Material: Nitrile rubber
  Minimum layer thickness: 0.11 mm
  Break through time: 30 min
  Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

  data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

  If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

- **Body Protection**
  
  Impervious clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

- **Respiratory protection**
  
  For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

- **Control of environmental exposure**
  
  Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: crystalline
   Colour: light yellow

b) Odour
   characteristic

c) Odour Threshold
   No data available

d) pH
   5.5

e) Melting point/freezing point
   Melting point/range: 68 - 70 °C (154 - 158 °F) - lit.

f) Initial boiling point and boiling range
   255 °C (491 °F) - lit.

g) Flash point
   110 °C (230 °F) - closed cup

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   The product is not flammable. - Flammability (solids)

j) Upper/lower flammability or explosive limits
   Upper explosion limit: 5.8 %(V)
   Lower explosion limit: 0.6 %(V)

k) Vapour pressure
   0.04 hPa (0.03 mmHg) at 20 °C (68 °F)
   5.5 hPa (4.1 mmHg) at 100 °C (212 °F)
   12.6 hPa (9.5 mmHg) at 115 °C (239 °F)
   95.7 hPa (71.8 mmHg) at 166 °C (331 °F)

l) Vapour density
   No data available

m) Relative density
   0.992 g/cm3

n) Water solubility
   0.0075 g/l at 15 °C (59 °F)

o) Partition coefficient: n-octanol/water
   log Pow: 4.008 at 25 °C (77 °F)

p) Auto-ignition temperature
   566 °C (1,051 °F) at 1,013.0 hPa (759.8 mmHg)

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information
   No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   No data available

10.4 Conditions to avoid
   No data available

10.5 Incompatible materials
   Strong oxidizing agents
10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
Inhalation: No data available
LD50 Dermal - Rabbit - > 5,010 mg/kg
No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Irritating to skin. - 24 h
(Draize Test)

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
Maximisation Test (GPMT) - Guinea pig
Does not cause skin sensitisation.
(OECD Test Guideline 406)

Germ cell mutagenicity
Ames test
S. typhimurium
Result: negative

Carcinogenicity
Carcinogenicity - Mouse - Oral

Carcinogenicity - Mouse - Subcutaneous
Tumorigenic: Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration: Tumors. Liver: Tumors.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: DU8050000
Liver injury may occur, Gastrointestinal disturbance
Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish  
flow-through test LC50 - Pimephales promelas (fathead minnow) - 3 mg/l - 96 h  
(OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates  
flow-through test EC50 - Daphnia magna (Water flea) - 0.36 mg/l - 48 h

12.2 Persistence and degradability
Biodegradability  
aerobic - Exposure time 14 d  
Result: 84 % - Readily biodegradable  
(OECD Test Guideline 301C)

12.3 Bioaccumulative potential
Bioaccumulation  
Leuciscus idus (Golden orfe) - 3 d - 50 µg/l

Bioconcentration factor (BCF): 281

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077  
Class: 9  
Packing group: III  
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Biphenyl)
Reportable Quantity (RQ): 100 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 3077  
Class: 9  
Packing group: III  
EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Biphenyl)
Marine pollutant:yes

IATA
UN number: 3077  
Class: 9  
Packing group: III  
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Biphenyl)
15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biphenyl</td>
<td>92-52-4</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
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<th>Revision Date</th>
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</thead>
<tbody>
<tr>
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Pennsylvania Right To Know Components

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<th>CAS-No.</th>
<th>Revision Date</th>
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<tbody>
<tr>
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<td>2007-07-01</td>
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New Jersey Right To Know Components

<table>
<thead>
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<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biphenyl</td>
<td>92-52-4</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

<table>
<thead>
<tr>
<th>Acute aquatic toxicity</th>
<th>Chronic aquatic toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute</td>
<td>Aquatic Chronic</td>
</tr>
<tr>
<td>Acute</td>
<td>Chronic</td>
</tr>
<tr>
<td>Eye irrit.</td>
<td>Eye irritation</td>
</tr>
<tr>
<td>H315</td>
<td>Causes skin irritation.</td>
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<td>H319</td>
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<td>H400</td>
<td>Very toxic to aquatic life.</td>
</tr>
<tr>
<td>H410</td>
<td>Very toxic to aquatic life with long lasting effects.</td>
</tr>
</tbody>
</table>

HMIS Rating

| Health hazard: | 2 |
| Chronic Health Hazard: | * |
| Flammability: | 1 |
| Physical Hazard | 0 |

NFPA Rating

| Health hazard: | 2 |
| Fire Hazard: | 1 |
| Reactivity Hazard: | 0 |

Further information
Copyright 2016 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers
Product name: 1,2,4,5-Tetramethylbenzene
Product Number: T19607
Brand: Aldrich
CAS-No.: 95-93-2

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES
Telephone: +1 314 771-5765
Fax: +1 800 325-5052

1.4 Emergency telephone
Emergency Phone #: 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable solids (Category 1), H228
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram:

Signal Word: Danger
Hazard statement(s): H228 Flammable solid.
H410     Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)
P210     Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P240     Ground/bond container and receiving equipment.
P241     Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P273     Avoid release to the environment.
P280     Wear protective gloves/ eye protection/ face protection.
P370 + P378    In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391     Collect spillage.
P501     Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances
Synonyms : Durene
            1,2,4,5-Tetramethylbenzene

Formula : C_{10}H_{14}
Molecular weight : 134.22 g/mol
CAS-No. : 95-93-2
EC-No. : 202-465-7

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2,4,5-tetramethylbenzene</td>
<td>Flam. Sol. 1; Aquatic Acute 1; Aquatic Chronic 1; H228, H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 1</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.
In case of eye contact
After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
- Water
- Foam
- Carbon dioxide (CO2)
- Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Combustible.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air on intense heating.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
In the event of fire, wear self-contained breathing apparatus.

5.4 Further information
Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact.
Ensure adequate ventilation. Keep away from heat and sources of ignition. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains. Risk of explosion.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.
SECTION 7: Handling and storage

7.1 Precautions for safe handling

**Advice on protection against fire and explosion**
Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharge.

**Hygiene measures**
Change contaminated clothing. Wash hands after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

**Storage conditions**
Tightly closed. Keep away from heat and sources of ignition.

**Storage class**
Storage class (TRGS 510): 4.1B: Flammable solid hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

**Ingredients with workplace control parameters**
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

**Appropriate engineering controls**
Change contaminated clothing. Wash hands after working with substance.

**Personal protective equipment**

**Eye/face protection**
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

**Skin protection**
Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

**Body Protection**
Flame retardant antistatic protective clothing.

**Respiratory protection**
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains. Risk of explosion.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance Form: crystals
b) Odor No data available
c) Odor Threshold No data available
d) pH No data available
e) Melting point/freezing point Melting point/range: 76 - 80 °C (169 - 176 °F) - lit.
f) Initial boiling point and boiling range 191 - 193 °C 376 - 379 °F
g) Flash point 74 °C (165 °F) - c.c.
h) Evaporation rate No data available
i) Flammability (solid, gas) The substance or mixture is a flammable solid with the category 1.
j) Upper/lower flammability or explosive limits No data available
k) Vapor pressure No data available
l) Vapor density No data available
m) Density 0.838 g/mL at 25 °C (77 °F) - lit.
   Relative density No data available
n) Water solubility No data available
 o) Partition coefficient: n-octanol/water No data available
p) Autoignition temperature No data available
q) Decomposition temperature No data available
r) Viscosity No data available
s) Explosive properties No data available
t) Oxidizing properties none

9.2 Other safety information
No data available
SECTION 10: Stability and reactivity

10.1 Reactivity
Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical.
The following applies in general to flammable organic substances and mixtures: in
correspondingly fine distribution, when whirled up a dust explosion potential may generally
be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature).

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Oxidizing agents

10.4 Conditions to avoid
Strong heating.

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 6,700 mg/kg
Remarks: (RTECS)
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No ingredient of this product present at levels greater than or equal to 0.1% is
identified as probable, possible or confirmed human carcinogen by IARC.
NTP: No ingredient of this product present at levels greater than or equal to 0.1% is
identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is
on OSHA’s list of regulated carcinogens.
Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information
RTECS: DC0500000
The data available to us do not suffice to permit any industrial-toxicological assessment.

Further toxicological data:
Risk of absorption.

Other dangerous properties can not be excluded.

Further data:
Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity
Toxicity to fish
LC0 - Leuciscus idus (Golden orfe) - 10 mg/l - 48 h
Remarks: (ECOTOX Database)

LC50 - Leuciscus idus (Golden orfe) - 30 mg/l - 48 h
Remarks: (ECOTOX Database)

LC100 - Leuciscus idus (Golden orfe) - 50 mg/l - 48 h
Remarks: (ECOTOX Database)

Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 0.47 mg/l - 48 h
Remarks: (External MSDS)

12.2 Persistence and degradability
Not readily biodegradable.

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available
12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)
UN number: 1325  Class: 4.1  Packing group: II
Proper shipping name: Flammable solids, organic, n.o.s. (1,2,4,5-tetramethylbenzene)
Reportable Quantity (RQ):
Poison Inhalation Hazard: No

IMDG
UN number: 1325  Class: 4.1  Packing group: II
EMS-No: F-A, S-G
Proper shipping name: FLAMMABLE SOLID, ORGANIC, N.O.S. (1,2,4,5-tetramethylbenzene)
Marine pollutant: yes

IATA
UN number: 1325  Class: 4.1  Packing group: II
Proper shipping name: Flammable solid, organic, n.o.s. (1,2,4,5-tetramethylbenzene)

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.
No components are subject to the Massachusetts Right to Know Act.

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2,4,5-tetramethylbenzene</td>
<td>95-93-2</td>
<td></td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2,4,5-tetramethylbenzene</td>
<td>95-93-2</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 16: Other information**

**Further information**

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.5    Revision Date: 05/02/2022    Print Date: 05/14/2022
SAFETY DATA SHEET

1. Identification

Product Name: Mesitylene
Cat No.: AC125580000; AC125580010; AC125580025; AC125580050; AC125582500
CAS No: 108-67-8
Synonyms: 1,3,5-Trimethylbenzene

Recommended Use: Laboratory chemicals.
Uses advised against: Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11
Emergency Number US: 001-201-796-7100 / Europe: +32 14 57 52 99
CHEMTREC Tel. No.US: 001-800-424-9300 / Europe: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

| Flammable liquids | Category 3 |
| Skin Corrosion/Irritation | Category 2 |
| Serious Eye Damage/Eye Irritation | Category 2 |
| Specific target organ toxicity (single exposure) | Category 3 |
| Target Organs - Respiratory system, Central nervous system (CNS). | Category 1 |

Label Elements

Signal Word
Danger

Hazard Statements
Flammable liquid and vapor
May be fatal if swallowed and enters airways
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool

Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse

Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Do NOT induce vomiting

Fire
In case of fire: Use CO2, dry chemical, or foam for extinction

Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>&lt;100</td>
</tr>
</tbody>
</table>

4. First-aid measures
General Advice
If symptoms persist, call a physician.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation
Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur. Risk of serious damage to the lungs (by aspiration).

Ingestion
Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Call a physician or poison control center immediately. If vomiting occurs naturally, have victim lean forward.

Most important symptoms and effects
None reasonably foreseeable. Vapors may cause drowsiness and dizziness: Symptoms may be delayed: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

5. Fire-fighting measures

Suitable Extinguishing Media
Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam. Water mist may be used to cool closed containers.

Unsuitable Extinguishing Media
No information available

Flash Point
44 °C / 111.2 °F

Autoignition Temperature
550 °C / 1022 °F

Explosion Limits
Upper 6.00%
Lower 1.00%

Hazardous Combustion Products
Carbon monoxide (CO), Carbon dioxide (CO₂).

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment as required. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions
Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up
Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage
Handling
Wear personal protective equipment/face protection. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Take precautionary measures against static discharges.

Storage.

8. Exposure controls / personal protection
Exposure Guidelines

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH</th>
<th>Mexico OEL (TWA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>TWA: 10 ppm</td>
<td>TWA: 25 ppm</td>
<td>TWA: 125 mg/m³³</td>
<td></td>
</tr>
</tbody>
</table>

Legend
ACGIH - American Conference of Governmental Industrial Hygienists
NIOSH - National Institute for Occupational Safety and Health

Engineering Measures
Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting equipment.

Person Protective Equipment
Eye/face Protection
Tight sealing safety goggles. Face protection shield.

Skin and body protection
Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended Filter type:
Organic gases and vapours filter. Type A. Brown. conforming to EN14387.

Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor</td>
<td>aromatic</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>-45 °C / -49 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>163 - 166 °C / 325.4 - 330.8 °F @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>44 °C / 111.2 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>6.00%</td>
</tr>
<tr>
<td>Upper</td>
<td>1.00%</td>
</tr>
</tbody>
</table>
10. Stability and reactivity

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid

Incompatible Materials
Strong oxidizing agents, Nitric acid

Hazardous Decomposition Products
Carbon monoxide (CO), Carbon dioxide (CO₂)

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>Not listed</td>
<td>Not listed</td>
<td>LC50 = 24 g/m³ ( Rat ) 4 h</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Irritating to eyes, respiratory system and skin

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
Not mutagenic in AMES Test

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
Respiratory system Central nervous system (CNS)

STOT - repeated exposure
None known
12. Ecological information

Ecotoxicity
Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>Not listed</td>
<td>LC50: = 3.48 mg/L, 96h (Pimephales promelas)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Persistence and Degradability
based on information available. May persist

Bioaccumulation/Accumulation
No information available.

Mobility
Is not likely mobile in the environment due its low water solubility.

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
- UN-No UN2325
  - Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
  - Hazard Class 3
  - Packing Group III

TDG
- UN-No UN2325
  - Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
  - Hazard Class 3
  - Packing Group III

IATA
- UN-No UN2325
  - Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
  - Hazard Class 3
  - Packing Group III

IMDG/IMO
- UN-No UN2325
  - Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
  - Hazard Class 3
  - Packing Group III

15. Regulatory information

United States of America Inventory

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No</th>
<th>TSCA</th>
<th>TSCA Inventory notification - Active-Inactive</th>
<th>TSCA - EPA Regulatory Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>X</td>
<td>ACTIVE</td>
<td>-</td>
</tr>
</tbody>
</table>
Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA - Per 40 CFR 751, Regulation of Certain Chemical Substances & Mixtures, Under TSCA Section 6(h) (PBT) Not applicable

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>PICCS</th>
<th>ENCS</th>
<th>ISHL</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>X</td>
<td>-</td>
<td>203-604-4</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Moderate risk, Grade 2

Authorisation/Restrictions according to EU REACH Not applicable

|--------------------------|---------|---------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
Safety, health and environmental regulations/legislation specific for the substance or mixture

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No</th>
<th>OECD HPV</th>
<th>Persistent Organic Pollutant</th>
<th>Ozone Depletion Potential</th>
<th>Restriction of Hazardous Substances (RoHS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>Listed</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3,5-Trimethylbenzene</td>
<td>108-67-8</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 26-Sep-2009
Revision Date 31-Jan-2023
Print Date 31-Jan-2023
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 1,2-Dichlorobenzene
Product Number : 240664
Brand : Sigma-Aldrich
Index-No. : 602-034-00-7
CAS-No. : 95-50-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 4), H227
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Skin sensitisation (Category 1), H317
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Warning
Hazard statement(s)
H227 Combustible liquid.
H302 + H332 Harmful if swallowed or if inhaled
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/ eye protection/ face protection.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>Molecular weight</th>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₆H₄Cl₂</td>
<td>147.00 g/mol</td>
<td>95-50-1</td>
<td>202-425-9</td>
<td>602-034-00-7</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>Flam. Liq. 4; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H227, H302 + H332, H315, H317, H319, H335, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Light sensitive.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated
8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>TWA</td>
<td></td>
<td>25.000000 ppm USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks
Upper Respiratory Tract irritation
Eye irritation
Liver damage
Not classifiable as a human carcinogen

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
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<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</table>

Upper Respiratory Tract irritation
Eye irritation
Liver damage
Not classifiable as a human carcinogen

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<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td></td>
<td>50.000000 ppm USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Upper Respiratory Tract irritation
Eye irritation
Liver damage
Not classifiable as a human carcinogen

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<thead>
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<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
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</thead>
<tbody>
<tr>
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<td></td>
<td>STEL</td>
<td></td>
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</tr>
</tbody>
</table>

Upper Respiratory Tract irritation
Eye irritation
Liver damage
Not classifiable as a human carcinogen

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<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td></td>
<td>50.000000 ppm</td>
<td>300.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

The value in mg/m³ is approximate. Ceiling limit is to be determined from breathing-zone air samples.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td></td>
<td>50.000000 ppm</td>
<td>300.000000 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)
Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 38 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

| a) Appearance | Form: liquid, clear Colour: colourless |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: -18 - -17 °C (0 - 1 °F) - lit. |
| f) Initial boiling point and boiling range | 178 - 180 °C (352 - 356 °F) - lit. |
| g) Flash point | 66.0 °C (150.8 °F) - closed cup |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | Upper explosion limit: 9.2 % (V) Lower explosion limit: 2.2 % (V) |
| k) Vapour pressure | 2.1 hPa (1.6 mmHg) at 35.0 °C (95.0 °F) 1.6 hPa (1.2 mmHg) at 20.0 °C (68.0 °F) |
| l) Vapour density | No data available |
| m) Relative density | 1.306 g/cm3 at 25 °C (77 °F) |
| n) Water solubility | ca.0.1558 g/l at 25 °C (77 °F) - partly soluble |
| o) Partition coefficient: n-octanol/water | log Pow: ca.3.433 at 25 °C (77 °F) |
| p) Auto-ignition temperature | 648.0 °C (1,198.4 °F) |
| q) Decomposition | No data available |
9.2 Other safety information

Surface tension ca. 36.61 mN/m

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 500.0 mg/kg
Inhalation: No data available
LD50 Dermal - Rabbit - > 10,000 mg/kg
No data available

Skin corrosion/irritation
Skin - Rabbit
(OECD Test Guideline 404)

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
in vivo assay - Mouse
May cause sensitisation by skin contact.
(OECD Test Guideline 429)

Germ cell mutagenicity
No data available

Ames test
Salmonella typhimurium
Result: negative

OECD Test Guideline 474
Mouse - male - Bone marrow
Result: negative

Carcinogenicity
IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (1,2-Dichlorobenzene)
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**
Repeated dose Rat - male and female - Oral - 24 h - NOAEL: 60 mg/kg - LOAEL: 125 mg/kg - OECD Test Guideline 408
RTECS: CZ4500000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

---

**12. ECOLOGICAL INFORMATION**

**12.1 Toxicity**

<table>
<thead>
<tr>
<th>Toxicty to fish</th>
<th>flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 1.58 mg/l - 96 h</th>
</tr>
</thead>
</table>

Toxicity to daphnia and other aquatic invertebrates

| Static test EC50 - Ceriodaphnia dubia (water flea) - 0.66 mg/l - 48 h |

Toxicity to algae

| Growth inhibition EC50 - Pseudokirchneriella subcapitata - 2.2 mg/l - 96 h |

**12.2 Persistence and degradability**

Biodegradability aerobic - Exposure time 28 d

Result: 0% - Not readily biodegradable.

(OECD Test Guideline 301C)

**12.3 Bioaccumulative potential**

Bioaccumulation Cyprinus carpio (Carp) - 56 d

- 0.01 mg/l

Bioconcentration factor (BCF): 90 - 260

(OECD Test Guideline 305C)

**12.4 Mobility in soil**
No data available

**12.5 Results of PBT and vPvB assessment**
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

**12.6 Other adverse effects**
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.
13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1591  Class: 6.1  Packing group: III
Proper shipping name: o-Dichlorobenzene
Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1591  Class: 6.1  Packing group: III  EMS-No: F-A, S-A
Proper shipping name: ortho-DICHLOROBENZENE
Marine pollutant:yes

IATA
UN number: 1591  Class: 6.1  Packing group: III
Proper shipping name: o-Dichlorobenzene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>2007-07-01</td>
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</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichlorobenzene</td>
<td>95-50-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.  Acute toxicity
Aquatic Acute  Acute aquatic toxicity
Aquatic Chronic Chronic aquatic toxicity
Eye Irrit. Eye irritation
Flam. Liq. Flammable liquids
H227 Combustible liquid.
H302 Harmful if swallowed.
H302 + H332 Harmful if swallowed or if inhaled
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.

**HMIS Rating**
- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 2
- Physical Hazard 1

**NFPA Rating**
- Health hazard: 2
- Fire Hazard: 2
- Reactivity Hazard: 0

**Further information**
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only.
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

**Preparation Information**
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7                      Revision Date: 11/26/2015          Print Date: 02/11/2016
1. PRODUCT AND COMPANY IDENTIFICATION

Product name: 1,3,5-Trimethylbenzene
Product Number: 442236
Brand: Supelco
Supplier: Sigma-Aldrich

Supplier Information:
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052
Emergency Phone #: (314) 776-6555
Preparation Information: Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Combustible Liquid, Target Organ Effect, Irritant

Target Organs
Peripheral nervous system., Central nervous system, Blood

GHS Classification
Flammable liquids (Category 3)
Acute toxicity, Inhalation (Category 5)
Skin irritation (Category 2)
Eye irritation (Category 2B)
Specific target organ toxicity - single exposure (Category 3)
Acute aquatic toxicity (Category 2)
Chronic aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram

Warning

Hazard statement(s)
H226 Flammable liquid and vapour.
H315 + H320 Causes skin and eye irritation.
H333 May be harmful if inhaled.
H335 May cause respiratory irritation.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273 Avoid release to the environment.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
HMIS Classification

- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 2
- Physical hazards: 0

NFPA Rating

- Health hazard: 2
- Fire: 2
- Reactivity Hazard: 0

Potential Health Effects

- Inhalation: May be harmful if inhaled. Causes respiratory tract irritation.
- Skin: May be harmful if absorbed through skin. Causes skin irritation.
- Eyes: Causes eye irritation.
- Ingestion: May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: Mesitylene, 1,3,5-Trimethylbenzene

Formula: C<sub>9</sub>H<sub>12</sub>
Molecular Weight: 120.19 g/mol

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesitylene</td>
<td>108-67-8</td>
<td>203-604-4</td>
<td>601-025-00-5</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Special protective equipment for fire-fighters
Wear self-contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES
Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet- brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesitylene</td>
<td>108-67-8</td>
<td>TWA</td>
<td>25 ppm</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>125 mg/m3</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>25 ppm</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>123 mg/m3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>25 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>125 mg/m3</td>
<td></td>
</tr>
</tbody>
</table>

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
impervious clothing, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance
Form liquid, clear
**Colour**
colourless

**Safety data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>no data available</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>Melting point/range: -45 °C (-49 °F) - lit.</td>
</tr>
<tr>
<td>Boiling point</td>
<td>163 - 166 °C (325 - 331 °F) - lit.</td>
</tr>
<tr>
<td>Flash point</td>
<td>53.0 °C (127.4 °F) - closed cup</td>
</tr>
<tr>
<td>Ignition temperature</td>
<td>550 °C (1,022 °F)</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>550.0 °C (1,022.0 °F)</td>
</tr>
<tr>
<td>Lower explosion limit</td>
<td>0.88 %(V)</td>
</tr>
<tr>
<td>Vapour pressure</td>
<td>18.7 hPa (14.0 mmHg) at 55.0 °C (131.0 °F)</td>
</tr>
<tr>
<td></td>
<td>3.3 hPa (2.5 mmHg) at 25.0 °C (77.0 °F)</td>
</tr>
<tr>
<td>Density</td>
<td>0.864 g/cm³ at 25 °C (77 °F)</td>
</tr>
<tr>
<td>Water solubility</td>
<td>no data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>no data available</td>
</tr>
<tr>
<td>Relative vapour density</td>
<td>no data available</td>
</tr>
<tr>
<td>Odour</td>
<td>no data available</td>
</tr>
<tr>
<td>Odour Threshold</td>
<td>no data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>no data available</td>
</tr>
</tbody>
</table>

**10. STABILITY AND REACTIVITY**

**Chemical stability**
Stable under recommended storage conditions.

**Possibility of hazardous reactions**
no data available

**Conditions to avoid**
Heat, flames and sparks.

**Materials to avoid**
Strong oxidizing agents

**Hazardous decomposition products**
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - no data available

**11. TOXICOLOGICAL INFORMATION**

**Acute toxicity**

<table>
<thead>
<tr>
<th>Route</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral LD50</td>
<td>no data available</td>
</tr>
<tr>
<td>Inhalation LC50</td>
<td>LC50 Inhalation - rat - 4 h - 24,000 mg/m³</td>
</tr>
<tr>
<td>Dermal LD50</td>
<td>no data available</td>
</tr>
<tr>
<td>Other information on acute toxicity</td>
<td>no data available</td>
</tr>
</tbody>
</table>

**Skin corrosion/irritation**
Skin - rabbit - Skin irritation - 24 h
Serious eye damage/eye irritation
Eyes - rabbit - Mild eye irritation - 24 h

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

Teratogenicity
no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion May be harmful if swallowed.
Skin May be harmful if absorbed through skin. Causes skin irritation.
Eyes Causes eye irritation.

Signs and Symptoms of Exposure
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects
no data available

Additional Information
RTECS: OX6825000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish LC50 - Carassius auratus (goldfish) - 12.52 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates. Immobilization EC50 - Daphnia magna (Water flea) - 6 mg/l - 48 h

Persistence and degradability
no data available
Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects
Toxic to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2325  Class: 3  Packing group: III
Proper shipping name: 1,3,5-Trimethylbenzene
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2325  Class: 3  Packing group: III
Proper shipping name: 1,3,5-TRIMETHYLBENZENE
Marine pollutant: No

EMS-No: F-E, S-D

IATA
UN number: 2325  Class: 3  Packing group: III
Proper shipping name: 1,3,5-Trimethylbenzene

15. REGULATORY INFORMATION

OSHA Hazards
Combustible Liquid, Target Organ Effect, Irritant

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesitylene</td>
<td>108-67-8</td>
<td>1994-04-01</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesitylene</td>
<td>108-67-8</td>
<td>1994-04-01</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesitylene</td>
<td>108-67-8</td>
<td>1994-04-01</td>
</tr>
</tbody>
</table>
California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information
Copyright 2011 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: 1,3-Butadiene

Product Number: 295035
Brand: Aldrich
Index-No.: 601-013-00-X

CAS-No.: 106-99-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
- Flammable gases (Category 1), H220
- Gases under pressure (Liquefied gas), H280
- Germ cell mutagenicity (Category 1B), H340
- Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
- H220: Extremely flammable gas.
- H280: Contains gas under pressure; may explode if heated.
- H340: May cause genetic defects.
- H350: May cause cancer.

Precautionary statement(s)
- P201: Obtain special instructions before use.
- P202: Do not handle until all safety precautions have been read and understood.
- P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
- P281: Use personal protective equipment as required.
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>C₄H₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular weight</td>
<td>54.09 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>106-99-0</td>
</tr>
<tr>
<td>EC-No.</td>
<td>203-450-8</td>
</tr>
<tr>
<td>Index-No.</td>
<td>601-013-00-X</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>Flam. Gas 1; Press. Gas</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Liquefied gas; Muta. 1B; Carc. 1A; H220, H280, H340, H350</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Clean up promptly by sweeping or vacuum.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid inhalation of vapour or mist. Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Recommended storage temperature 2 - 8 °C
Contents under pressure. Air sensitive. Shock or heat may detonate. May explode when heated. Handle and store under inert gas.
Storage class (TRGS 510): Gases

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>Potential Occupational Carcinogen \nSee Appendix A</td>
</tr>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>TWA</td>
<td>2 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cancer \nSuspected human carcinogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>2.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cancer \nSuspected human carcinogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>1 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Substance listed; for more information see OSHA document 29 CFR 1910.1051; 29 CFR 1910.19(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>1.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Substance listed; for more information see OSHA document 29 CFR 1910.1051; 29 CFR 1910.19(1)</td>
</tr>
<tr>
<td>Substance</td>
<td>Limit</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEL 5 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEL 5.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEL 1.000000 ppm</td>
<td>OSHA Specifically Regulated Chemicals/Carcinogens</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1910.1051

This section applies to all occupational exposures to 1,3-Butadiene (BD), Chemical Abstracts Service Registry No. 106-99-0, except as provided in paragraph (a)(2) of this section. Except for the recordkeeping provisions in paragraph (m)(1) of this section, this section does not apply to the processing, use, or handling of products containing BD or to other work operations and streams in which BD is present where objective data are reasonably relied upon that demonstrate the work operation or the product or the group of products or operations to which it belongs may not reasonably be foreseen to release BD in airborne concentrations at or above the action level or in excess of the STEL under the expected conditions of processing, use, or handling that will cause the greatest possible release or in any plausible accident. This section also does not apply to work operations, products or streams where the only exposure to BD is from liquid mixtures containing 0.1% or less of BD by volume or the vapors released from such liquids, unless objective data become available that show that airborne concentrations generated by such mixtures can exceed the action level or STEL under reasonably predictable conditions of processing, use or handling that will cause the greatest possible release. Except for labeling requirements and requirements for emergency response, this section does not apply to the storage, transportation, distribution or sale of BD or liquid mixtures in intact containers or in transportation pipelines sealed in such a manner as to fully contain BD vapors or liquid. Where products or processes containing BD are exempted under paragraph (a)(2) of this section, the employer shall maintain records of the objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in paragraph (m)(1) of this section.

1,3-Butadiene means an organic compound with chemical formula CH2\text{-}CH=CH\text{-}CH2 that has a molecular weight of approximately 54.15 g/mole.

OSHA specifically regulated carcinogen.
action level or in excess of the STEL under the expected conditions of processing, use, or handling that will cause the greatest possible release or in any plausible accident. This section also does not apply to work operations, products or streams where the only exposure to BD is from liquid mixtures containing 0.1% or less of BD by volume or the vapors released from such liquids. unless objective data become available that show that airborne concentrations generated by such mixtures can exceed the action level or STEL under reasonably predictable conditions of processing, use or handling that will cause the greatest possible release. Except for labeling requirements and requirements for emergency response, this section does not apply to the storage, transportation, distribution or sale of BD or liquid mixtures in intact containers or in transportation pipelines sealed in such a manner as to fully contain BD vapors or liquid. Where products or processes containing BD are exempted under paragraph (a)(2) of this section, the employer shall maintain records of the objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in paragraph (m)(1) of this section. 1,3-Butadiene means an organic compound with chemical formula CH2=CH-CH=CH2 that has a molecular weight of approximately 54.15 g/mole. OSHA specifically regulated carcinogen.

<table>
<thead>
<tr>
<th>Biological occupational exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>1,3-Butadiene</td>
</tr>
</tbody>
</table>

Remarks: End of shift (As soon as possible after exposure ceases)

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixture of N-1 and N-2(hydroxybutenyl)valine</td>
<td>2.5pmol/g</td>
<td>Hemoglobin (Hb) adducts in blood</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Not critical

8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals. Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- **a) Appearance**
  - Form: Liquefied gas

- **b) Odour**
  - No data available

- **c) Odour Threshold**
  - No data available

- **d) pH**
  - No data available

- **e) Melting point/freezing point**
  - Melting point range: -109 °C (-164 °F) - lit.

- **f) Initial boiling point and boiling range**
  - -4.5 °C (23.9 °F) - lit.

- **g) Flash point**
  - -75.99 °C (-104.78 °F) - closed cup - Tested according to Annex V of Directive 67/548/EEC.

- **h) Evaporation rate**
  - No data available

- **i) Flammability (solid, gas)**
  - No data available

- **j) Upper/lower flammability or explosive limits**
  - Upper explosion limit: 16.3 %(V)
  - Lower explosion limit: 1.4 %(V)

- **k) Vapour pressure**
  - ca.2,400 hPa (1,800 mmHg) at 20 °C (68 °F)
  - 3,200 hPa (2,400 mmHg) at 30 °C (86 °F)
  - 5,700 hPa (4,275 mmHg) at 50 °C (122 °F)

- **l) Vapour density**
  - No data available

- **m) Relative density**
  - 0.62 g/cm3 at 20 °C (68 °F)

- **n) Water solubility**
  - 0.5 g/l at 20 °C (68 °F) - Tested according to Annex V of Directive 67/548/EEC.

- **o) Partition coefficient: n-octanol/water**
  - log Pow: 1.85 at 23 °C (73 °F)

- **p) Auto-ignition temperature**
  - No data available
9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Test for peroxide formation before using or discard after 3 months.
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Oxidizing agents, Oxygen, Copper, Copper alloys, Carbides, Halogens, Metal oxides, Metals

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 5,480 mg/kg
LC50 Inhalation - Rat - 4 h - 285 mg/l
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
In vivo tests showed mutagenic effects

Carcinogenicity
Carcinogenicity - Rat - Inhalation
Tumorigenic:Carcinogenic by RTECS criteria. Cardiac:Tumors. Lungs, Thorax, or Respiration:Tumors.

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (1,3-Butadiene)
NTP: Known to be human carcinogen (1,3-Butadiene)
OSHA: OSHA specifically regulated carcinogen (1,3-Butadiene)

Reproductive toxicity
No data available

Reproductive toxicity - Mouse - Inhalation
Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).
No data available

Developmental Toxicity - Rat - Inhalation
Specific Developmental Abnormalities: Musculoskeletal system.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available
Cholinesterase inhibitors can cause heavy salivation and secretion in the lungs, lachrymation, blurred vision, involuntary defeation, diarrhea, tremor, ataxia, sweating, hypothermia, lowered heart rate, and/or a fall in blood pressure as a result of their action at cholinergic nerve sites., narcosis, Headache, Nausea, Vomiting, Dizziness, Drowsiness, Confusion., Weakness, Muscle cramps/spasms., Change in pupil size., Tremors, Seizures., Incoordination., Convulsions, Coma
Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - other fish - 71.5 mg/l - 24 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.
14. TRANSPORT INFORMATION

**DOT (US)**

UN number: 1010  
Class: 2.1  
Proper shipping name: Butadienes, stabilized  
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

**IMDG**

UN number: 1010  
Class: 2.1  
Proper shipping name: BUTADIENES, STABILIZED  
EMS-No: F-D, S-U

**IATA**

UN number: 1010  
Class: 2.1  
Proper shipping name: Butadienes, stabilized  
IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

**SARA 302 Components**

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**

The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazards**

Fire Hazard, Sudden Release of Pressure Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**

WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-Butadiene</td>
<td>106-99-0</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carc.</td>
<td>Carcinogenicity</td>
</tr>
<tr>
<td>Flam. Gas</td>
<td>Flammable gases</td>
</tr>
<tr>
<td>H220</td>
<td>Extremely flammable gas.</td>
</tr>
</tbody>
</table>
H280 Contains gas under pressure; may explode if heated.
H340 May cause genetic defects.
H350 May cause cancer.
Muta. Germ cell mutagenicity
Press. Gas Gases under pressure

**HMIS Rating**

Health hazard: 0
Chronic Health Hazard: *
Flammability: 4
Physical Hazard: 3

**NFPA Rating**

Health hazard: 0
Fire Hazard: 4
Reactivity Hazard: 0

**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

**Preparation Information**

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.6 Revision Date: 03/03/2015 Print Date: 03/03/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: 2,2,4-Trimethylpentane
Product Number: 360597
Brand: Sigma-Aldrich
Index-No.: 601-009-00-8
CAS-No.: 540-84-1

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word: Danger

Hazard statement(s)
H225: Highly flammable liquid and vapour.
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H336: May cause drowsiness or dizziness.
H410: Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P321 Specific treatment (see supplemental first aid instructions on this label).
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms: Isooctane

Formula: C₈H₁₈
Molecular weight: 114.23 g/mol
CAS-No.: 540-84-1
EC-No.: 208-759-1
Index-No.: 601-009-00-8
Registration number: 01-2119457965-22-XXXX

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2,4-Trimethylpentane</td>
<td>Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.
If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Nature of decomposition products not known.
Carbon oxides
Flash back possible over considerable distance. Container explosion may occur under fire conditions.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.
7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2,4-Trimethylpentane</td>
<td>540-84-1</td>
<td>TWA</td>
<td>300.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks: Upper Respiratory Tract irritation

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 482 min
Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 90 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Appearance</td>
<td>Form: liquid</td>
</tr>
<tr>
<td>b) Odour</td>
<td>No data available</td>
</tr>
<tr>
<td>c) Odour Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d) pH</td>
<td>No data available</td>
</tr>
<tr>
<td>e) Melting point/freezing point</td>
<td>Melting point/range: -107 °C (-161 °F)</td>
</tr>
<tr>
<td>f) Initial boiling point and boiling range</td>
<td>98 - 99 °C (208 - 210 °F)</td>
</tr>
<tr>
<td>g) Flash point</td>
<td>-12 °C (10 °F) - closed cup</td>
</tr>
<tr>
<td>h) Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>i) Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>j) Upper/lower flammability or explosive limits</td>
<td>Upper explosion limit: 6 %(V)</td>
</tr>
<tr>
<td>k) Vapour pressure</td>
<td>55 hPa (41 mmHg) at 21 °C (70 °F)</td>
</tr>
<tr>
<td></td>
<td>117 hPa (88 mmHg) at 37.80 °C (100.04 °F)</td>
</tr>
<tr>
<td>l) Vapour density</td>
<td>3.94 - (Air = 1.0)</td>
</tr>
<tr>
<td>m) Relative density</td>
<td>0.692 g/mL at 25 °C (77 °F)</td>
</tr>
<tr>
<td>n) Water solubility</td>
<td>insoluble</td>
</tr>
<tr>
<td>o) Partition coefficient: n-octanol/water</td>
<td>log Pow: 4.6</td>
</tr>
<tr>
<td>p) Auto-ignition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>q) Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>r) Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>s) Explosive properties</td>
<td>No data available</td>
</tr>
<tr>
<td>t) Oxidizing properties</td>
<td>No data available</td>
</tr>
</tbody>
</table>

9.2 Other safety information

Relative vapour density 3.94 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.
10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - > 5,000 mg/kg
(OECD Test Guideline 401)

LC50 Inhalation - Rat - 4 h - > 33.52 mg/l
(OECD Test Guideline 403)

LD50 Dermal - Rabbit - > 2,000 mg/kg
(OECD Test Guideline 402)

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Irritating to skin.
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity

Rat
Unscheduled DNA synthesis

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.
Additional Information
RTECS: SA3320000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Liver - Irregularities - Based on Human Evidence
Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1262 Class: 3 Packing group: II
Proper shipping name: Octanes
Reportable Quantity (RQ): 1000 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 1262 Class: 3 Packing group: II
Proper shipping name: OCTANES
Marine pollutant:yes
EMS-No: F-E, S-E

IATA
UN number: 1262 Class: 3 Packing group: II
Proper shipping name: Octanes

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>540-84-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

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<tr>
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<td>2007-03-01</td>
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New Jersey Right To Know Components

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</thead>
<tbody>
<tr>
<td>540-84-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute: Acute aquatic toxicity
Aquatic Chronic: Chronic aquatic toxicity
Asp. Tox.: Aspiration hazard
Flam. Liq.: Flammable liquids
H225: Highly flammable liquid and vapour.
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H336: May cause drowsiness or dizziness.
H400: Very toxic to aquatic life.
H410: Very toxic to aquatic life with long lasting effects.
Skin Irrit.: Skin irritation

HMIS Rating
Health hazard: 2
Chronic Health Hazard: 0
Flammability: 3
Physical Hazard: 0

NFPA Rating
Health hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 11/03/2015 Print Date: 04/01/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: 2,4-Dimethylphenol

Product Number: D174203
Brand: Aldrich
Index-No.: 604-006-00-X
CAS-No.: 105-67-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 3), H311
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H301 + H311 Toxic if swallowed or in contact with skin
H314 Causes severe skin burns and eye damage.
H401 Toxic to aquatic life.

Precautionary statement(s)
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>4-Hydroxy-m-xylene</th>
</tr>
</thead>
<tbody>
<tr>
<td>asyrm.-m-Xylenol</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Formula</th>
<th>C₈H₁₀O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular weight</td>
<td>122.16 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>105-67-9</td>
</tr>
<tr>
<td>EC-No.</td>
<td>203-321-6</td>
</tr>
<tr>
<td>Index-No.</td>
<td>604-006-00-X</td>
</tr>
</tbody>
</table>

**Hazardous components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-Xylenol</td>
<td>Acute Tox. 3; Skin Corr. 1B; Eye Dam. 1; Aquatic Acute 2; H301 + H311, H314, H401</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

**In case of eye contact**
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

**If swallowed**
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 60 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| a) Appearance | Form: Semi-solid melting to a liquid, clear Colour: brown |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: 22 - 23 °C (72 - 73 °F) - lit. |
| f) Initial boiling point and boiling range | 211 - 212 °C (412 - 414 °F) - lit. |
| g) Flash point | 94.0 °C (201.2 °F) - closed cup |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | 0.1 hPa (0.1 mmHg) at 25.0 °C (77.0 °F) |
| l) Vapour density | No data available |
m) Relative density  
Relative density 1.011 g/cm³ at 25 °C (77 °F)

n) Water solubility  
No data available

o) Partition coefficient: n-octanol/water  
log Pow: 2.35

p) Auto-ignition temperature  
No data available

q) Decomposition temperature  
No data available

r) Viscosity  
No data available

s) Explosive properties  
No data available

t) Oxidizing properties  
No data available

9.2 Other safety information  
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity  
No data available

10.2 Chemical stability  
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions  
No data available

10.4 Conditions to avoid  
No data available

10.5 Incompatible materials  
Bases, Acid chlorides, Acid anhydrides, Oxidizing agents, Brass, Copper

10.6 Hazardous decomposition products  
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity  
LD₅₀ Oral - Rat - 3,200 mg/kg
Inhalation: No data available
LD₅₀ Dermal - Rat - 1,040 mg/kg
No data available

Skin corrosion/Irritation  
Causes burns.

Serious eye damage/eye irritation  
Risk of serious damage to eyes.

Respiratory or skin sensitisation  
No data available

Germ cell mutagenicity  
No data available

Carcinogenicity  
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: ZE5600000

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
LC50 - Oncorhynchus mykiss (rainbow trout) - 9.2 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates
LC50 - Daphnia magna (Water flea) - 2.1 mg/l - 48 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential
Bioaccumulation
Lepomis macrochirus (Bluegill) - 28 d
- 0.0102 mg/l

Bioconcentration factor (BCF): 150

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.
14. TRANSPORT INFORMATION

**DOT (US)**
- UN number: 2261  Class: 6.1  Packing group: II
- Proper shipping name: Xylenols, solid
- Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

**IMDG**
- UN number: 2261  Class: 6.1  Packing group: II
- Proper shipping name: XYLENOLS, SOLID
- EMS-No: F-A, S-A

**IATA**
- UN number: 2261  Class: 6.1  Packing group: II
- Proper shipping name: Xylenols, solid

15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
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<td>2,4-Xylenol</td>
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**SARA 311/312 Hazards**

**Massachusetts Right To Know Components**

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**Pennsylvania Right To Know Components**

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**New Jersey Right To Know Components**

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<tr>
<td>2,4-Xylenol</td>
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**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

**Full text of H-Statements referred to under sections 2 and 3.**

- **Acute Tox.**  Acute toxicity
- **Aquatic Acute**  Acute aquatic toxicity
- **Eye Dam.**  Serious eye damage
- **H301**  Toxic if swallowed.
- **H301 + H311**  Toxic if swallowed or in contact with skin
- **H311**  Toxic in contact with skin.
- **H314**  Causes severe skin burns and eye damage.

**HMIS Rating**
- Health hazard: 3
- Chronic Health Hazard: 1
- Flammability: 1
Physical Hazard 0

**NFPA Rating**

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard</td>
<td>3</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>1</td>
</tr>
<tr>
<td>Reactivity Hazard</td>
<td>0</td>
</tr>
</tbody>
</table>

**Further information**

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**Preparation Information**

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.5 Revision Date: 01/18/2016 Print Date: 02/09/2016
Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name
1,2-Butadiene

Synonyms
Methylallene; 1-Methylallene

Chemical Family
Hydrocarbons, aliphatic

Product Use
Industrial and Specialty Gas Applications.

Restrictions on Use
None known.

Details of the supplier of the safety data sheet
MATHESON TRI-GAS, INC.
150 Allen Road, Suite 302
Basking Ridge, NJ 07920
General Information: 1-800-416-2505
Emergency #: 1-800-424-9300 (CHEMTREC)
Outside the US: 703-527-3887 (Call collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.

Flammable Gases - Category 1
Gases Under Pressure - Liquefied gas
Skin Corrosion/Irritation - Category 2
Serious Eye Damage/Eye Irritation - Category 2B
Specific target organ toxicity - Single exposure - Category 3 (respiratory tract)

GHS Label Elements
Symbol(s)

Signal Word
Danger

Hazard Statement(s)
Extremely flammable gas.
Contains gas under pressure; may explode if heated.
Causes skin irritation.
Causes eye irritation.
May cause respiratory irritation.

Precautionary Statement(s)
Prevention
Keep away from heat, sparks, open flame, and hot surfaces - No smoking.
Wash thoroughly after handling.
Wear protective gloves.
Avoid breathing gas. Use only outdoors or in a well-ventilated area.

Response
Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.
IF INHALED.
Remove to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or doctor/physician if you feel unwell.
IF ON SKIN.
Wash with plenty of water. If skin irritation occurs. Get medical advice/attention.
Take off contaminated clothing and wash before reuse.
IF IN EYES.
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists. Get medical advice/attention.

Storage
Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal
Dispose in accordance with all applicable regulations.

Other Hazards
Rapid release of compressed gas may cause frostbite.

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CAS</th>
<th>Component Name</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>590-19-2</td>
<td>1,2-Butadiene</td>
<td>100</td>
</tr>
</tbody>
</table>

### Section 4 - FIRST AID MEASURES

**Inhalation**
If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

**Skin**
If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115°F; 41-46°C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

**Eyes**
Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

**Ingestion**
If swallowed, get medical attention.

**Most Important Symptoms/Effects**

**Acute**
frostbite, respiratory tract irritation, skin irritation, eye irritation
Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media
Suitable Extinguishing Media
carbon dioxide, regular dry chemical. Large fires: Use regular foam or flood with fine water spray.

Unsuitable Extinguishing Media
None known.

Special Hazards Arising from the Chemical
Severe fire hazard. Severe explosion hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

Hazardous Combustion Products
Oxides of carbon

Fire Fighting Measures
Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking.

Special Protective Equipment and Precautions for Firefighters
Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Wear personal protective clothing and equipment, see Section 8.

Methods and Materials for Containment and Cleaning Up
Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering. Avoid heat, flames, sparks and other sources of ignition. Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray.

Environmental Precautions
Avoid release to the environment.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling
Keep away from heat/sparks/open flame/hot surfaces - No smoking. Wash hands thoroughly after handling. Wear protective gloves. Avoid breathing gas. Use only outdoors or in a well-ventilated area.

Conditions for Safe Storage, Including any Incompatibilities
Store in a well-ventilated place.
Keep container tightly closed.
Store locked up.

**Incompatible Materials**
oxidizing materials

### Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

<table>
<thead>
<tr>
<th>Component Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1,2-Butadiene</strong></td>
</tr>
<tr>
<td>1000 ppm TWA VLE-PPT ; 2200 mg/m3 TWA VLE-PPT (related to Butadienes)</td>
</tr>
<tr>
<td>1250 ppm STEL [PPT-CT ]; 2750 mg/m3 STEL [PPT-CT ] (related to Butadienes)</td>
</tr>
</tbody>
</table>

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)
There are no biological limit values for any of this product's components.

**Engineering Controls**
Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

**Individual Protection Measures, such as Personal Protective Equipment**

**Eye/face protection**
Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

**Skin Protection**
For the gas: Wear appropriate chemical resistant clothing. For the liquid: Wear appropriate protective, cold insulating clothing.

**Respiratory Protection**
Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**Glove Recommendations**
For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves.

### Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Appearance</th>
<th>colorless gas</th>
<th>Physical State</th>
<th>gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Slight</td>
<td>Color</td>
<td>colorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available</td>
<td>pH</td>
<td>Not available</td>
</tr>
<tr>
<td>Melting Point</td>
<td>-136 °C (-213 °F)</td>
<td>Boiling Point</td>
<td>11 °C (52 °F)</td>
</tr>
</tbody>
</table>
Section 10 - STABILITY AND REACTIVITY

Reactivity
Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Chemical Stability
May explode if exposed to shock, friction or heating.

Possibility of Hazardous Reactions
May polymerize. Avoid contact with incompatible materials.

Conditions to Avoid
Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Minimize contact with material.

Incompatible Materials
oxidizing materials

Hazardous decomposition products
Oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure
Inhalation
irritation, headache, drowsiness, dizziness, loss of coordination, lung congestion
Material Name: 1,2-Butadiene

Skin Contact
irritation

Eye Contact
irritation

Ingestion
No information available for the product.

Acute and Chronic Toxicity

Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and no selected endpoints have been identified.

Product Toxicity Data
Acute Toxicity Estimate
No data available.

Immediate Effects
frostbite, respiratory tract irritation, skin irritation, eye irritation

Delayed Effects
No data available.

Irritation/Corrosivity Data
No animal testing data available for skin or eyes.

Respiratory Sensitization
No data available.

Dermal Sensitization
No data available.

Component Carcinogenicity
None of this product's components are listed by ACGIH, IARC, NTP, DFG or OSHA

Germ Cell Mutagenicity
No data available.

Tumorigenic Data
No data available

Reproductive Toxicity
No data available.

Specific Target Organ Toxicity - Single Exposure
Respiratory system

Specific Target Organ Toxicity - Repeated Exposure
No data available.

Aspiration hazard
Not applicable.

Medical Conditions Aggravated by Exposure
None known.

Section 12 - ECOLOGICAL INFORMATION

Component Analysis - Aquatic Toxicity
No LOLI ecotoxicity data are available for this product's components.

Persistence and Degradability
No data available.

Bioaccumulative Potential
Bioconcentration potential is low (BCF <100 or log Kow <3).

Mobility
No data available.
Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262.

Hazardous Waste Number(s): D001. D003.

Component Waste Numbers
The U.S. EPA has not published waste numbers for this product's components.

Section 14 - TRANSPORT INFORMATION

US DOT Information:
Shipping Name: BUTADIENES, STABILIZED
Hazard Class: 2.1
UN/NA #: UN1010
Required Label(s): 2.1

IMDG Information:
Shipping Name: BUTADIENES, STABILIZED
Hazard Class: 2.1
UN#: UN1010
Required Label(s): 2.1

International Bulk Chemical Code
This material does not contain any chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations
None of this product's components are listed under SARA Sections 302/304 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), or require an OSHA process safety plan.

SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories
Flammable; Gas Under Pressure; Skin Corrosion/Irritation; Serious Eye Damage/Eye Irritation; Specific Target Organ Toxicity

U.S. State Regulations
None of this product's components are listed on the state lists from CA, MA, MN, NJ or PA.

Not listed under California Proposition 65

Canada Regulations
Canadian WHMIS Ingredient Disclosure List (IDL)
The components of this product are either not listed on the IDL or are present below the threshold limit listed on the IDL.

Component Analysis - Inventory
1,2-Butadiene (590-19-2)

Section 16 - OTHER INFORMATION

NFPA Ratings
Material Name: 1,2-Butadiene

Health: 2 Fire: 4 Reactivity: 3

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes
Updated: 05/01/2015

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC - European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); LD50/LC50 - Lethal Dose/ Lethal Concentration; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ - ChemADVISOR’s Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX - Mexico; NDSL - Non-Domestic Substance List (Canada); NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL - Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TCCA - Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act; TW - Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); VN NCI (Draft) - Vietnam National Chemicals Inventory (NCI) (Draft); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

Disclaimer:
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Material Safety Data Sheet
2-Hexanone MSDS

Section 1: Chemical Product and Company Identification

Product Name: 2-Hexanone
Catalog Codes: SLH2950
CAS#: 591-78-6
RTECS: MP1400000
TSCA: TSCA 8(b) inventory: 2-Hexanone
CI#: Not available.
Synonym: Methyl butyl ketone
Chemical Formula: C6H12O

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>{2-}Hexanone</td>
<td>591-78-6</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: 2-Hexanone: ORAL (LD50): Acute: 2590 mg/kg [Rat]. 2430 mg/kg [Mouse]. DERMAL (LD50): Acute: 4860 mg/kg [Rabbit]. VAPOR (LC50): Acute: 8000 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation (lung irritant). Hazardous in case of skin contact (irritant), of ingestion, . Slightly hazardous in case of skin contact (permeator). Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

**Serious Skin Contact:**
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:**
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 533°C (991.4°F)

**Flash Points:**
- CLOSED CUP: 23°C (73.4°F).
- OPEN CUP: 28°C (82.4°F) (TAG).

**Flammable Limits:**
- LOWER: 1.2%
- UPPER: 8%

**Products of Combustion:** These products are carbon oxides (CO, CO2).

**Fire Hazards in Presence of Various Substances:** Flammable in presence of open flames and sparks.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

### Section 6: Accidental Release Measures

**Small Spill:**
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill:**
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

### Section 7: Handling and Storage
Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 CEIL: 40 (ppm) TWA: 100 CEIL: 165 (mg/m³) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.
Odor: Not available.
Taste: Not available.
Molecular Weight: 100.16 g/mole
Color: Colorless to light yellow.
pH (1% soln/water): Not available.
Boiling Point: 127.5°C (261.5°F)
Melting Point: -56.9°C (-70.4°F)
Critical Temperature: Not available.
Specific Gravity: 0.8113 (Water = 1)
Vapor Pressure: 12 mm of Hg (@ 20°C)
Vapor Density: 3.45 (Air = 1)
Vatility: Not available.
Odor Threshold: 0.18 ppm
Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0
Ionicity (in Water): Not available.
Dispersion Properties: See solubility in water, acetone.
Solubility:
Easily soluble in acetone. Partially soluble in cold water.

---

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

### Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2430 mg/kg [Mouse]. Acute dermal toxicity (LD50): 4860 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 8000 ppm 4 hour(s) [Rat].

**Chronic Effects on Humans:** Not available.

**Other Toxic Effects on Humans:**
Very hazardous in case of inhalation (lung irritant). Hazardous in case of skin contact (irritant), of ingestion,. Slightly hazardous in case of skin contact (permeator).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Passes through the placental barrier in animal. Testicular damage in animal.

**Special Remarks on other Toxic Effects on Humans:** Not available.

### Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information
DOT Classification: Class 3: Flammable liquid.

Identification: Ketone Liquid, n.o.s. (2-Hexanone) : UN1224 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: 2-Hexanone Pennsylvania RTK: 2-Hexanone Florida: 2-Hexanone Massachusetts RTK: 2-Hexanone New Jersey: 2-Hexanone TSCA 8(b) inventory: 2-Hexanone

Other Regulations:

Other Classifications:
WHMIS (Canada): CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

DSCL (EEC):
R10- Flammable. R37/38- Irritating to respiratory system and skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):
  Health Hazard: 2
  Fire Hazard: 3
  Reactivity: 0
  Personal Protection: h

National Fire Protection Association (U.S.A.):
  Health: 2
  Flammability: 3
  Reactivity: 0
  Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:43 PM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
1. Identification

Product Name: 2-Methylnaphthalene, 99% (gc)

Cat No.: AC414551000; AC414555000

Synonyms: No information available

Recommended Use: Laboratory chemicals.

Uses advised against: No information available

Details of the supplier of the safety data sheet:

Company: Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name: Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number:
For information US call: 001-800-ACROS-01
/Europe call: +32 14 57 52 11
Emergency Number US: 001-201-796-7100
Europe: +32 14 57 52 99
CHEMTREC Tel. No.US: 001-800-424-9300
Europe: 001-703-527-3887

2. Hazard(s) identification

Classification:
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Label Elements:

Signal Word: Warning

Hazard Statements:
Acute oral toxicity Category 4
Skin Corrosion/irritation Category 2
Serious Eye Damage/Eye Irritation Category 2
Specific target organ toxicity (single exposure) Category 3
Target Organs - Respiratory system.
Precautionary Statements

Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area

Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse

Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth

Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up

Disposal
Dispose of contents/container to an approved waste disposal plant

 Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>91-57-6</td>
<td>99.0</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes.

Inhalation
Move to fresh air.

Ingestion
Do not induce vomiting.

Most important symptoms/effects
No information available.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Unsuitable Extinguishing Media
No information available
2-Methylnaphthalene, 99% (gc)  

Revision Date  10-Feb-2015

**Flash Point**
Method - No information available

**Autoignition Temperature**
No information available

**Explosion Limits**
- Upper: No data available
- Lower: No data available

**Sensitivity to Mechanical Impact**
No information available

**Sensitivity to Static Discharge**
No information available

**Specific Hazards Arising from the Chemical**
Keep product and empty container away from heat and sources of ignition.

**Hazardous Combustion Products**
None known

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

<table>
<thead>
<tr>
<th></th>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**6. Accidental release measures**

**Personal Precautions**
Ensure adequate ventilation. Use personal protective equipment.

**Environmental Precautions**
See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

**Methods for Containment and Clean Up**
No information available.

**7. Handling and storage**

**Handling**
Ensure adequate ventilation.

**Storage**
Keep containers tightly closed in a dry, cool and well-ventilated place.

**8. Exposure controls / personal protection**

**Exposure Guidelines**

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>TWA: 0.5 ppm Skin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Quebec</th>
<th>Mexico OEL (TWA)</th>
<th>Ontario TWAEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td></td>
<td>TWA: 0.5 ppm Skin</td>
<td></td>
</tr>
</tbody>
</table>

**Legend**

ACGIH - American Conference of Governmental Industrial Hygienists

**Engineering Measures**
Ensure adequate ventilation, especially in confined areas.

**Personal Protective Equipment**

**Eye/face Protection**
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection**
Wear appropriate protective gloves and clothing to prevent skin exposure.
**2-Methylnaphthalene, 99% (gc)**

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Handle in accordance with good industrial hygiene and safety practice.

### 9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
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<tr>
<td>Appearance</td>
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<tr>
<td>Odor</td>
<td>Odorless</td>
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<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td></td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>37 38 °C</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td></td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
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<tr>
<td>Flammability or explosive limits</td>
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</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>&lt; 1 mmHg @ 25 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
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<tr>
<td>Relative Density</td>
<td>1.0000</td>
</tr>
<tr>
<td>Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No information available</td>
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<tr>
<td>Molecular Formula</td>
<td>C11H10</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>142.20</td>
</tr>
</tbody>
</table>

### 10. Stability and reactivity

- **Reactive Hazard**: None known, based on information available
- **Stability**: Stable under normal conditions.
- **Conditions to Avoid**: Incompatible products.
- **Incompatible Materials**: Strong oxidizing agents
- **Hazardous Decomposition Products**: None under normal use conditions
- **Hazardous Polymerization**: Hazardous polymerization does not occur.
- **Hazardous Reactions**: None under normal processing.

### 11. Toxicological information

#### Acute Toxicity

<table>
<thead>
<tr>
<th>Component Information</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>1630 mg/kg (Rat)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

- **Toxicologically Synergistic Products**
  - No information available

- **Delayed and immediate effects as well as chronic effects from short and long-term exposure**
  - No information available

- **Irritation**
  - No information available
Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>91-57-6</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
Respiratory system

STOT - repeated exposure
None known

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>Not listed</td>
<td>Pimephales promelas:LC50 = 2.5mg/L</td>
<td>Not listed</td>
<td>EC50 = 1.5 mg/L/48h</td>
</tr>
</tbody>
</table>

Persistence and Degradability
No information available

Bioaccumulation/ Accumulation
No information available.

Mobility
No information available.

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>3.86</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

<table>
<thead>
<tr>
<th>DOT</th>
<th>Not regulated</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDG</td>
<td>Not regulated</td>
</tr>
<tr>
<td>IATA</td>
<td>Not regulated</td>
</tr>
<tr>
<td>IMDG/IMO</td>
<td>Not regulated</td>
</tr>
</tbody>
</table>

15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>202-078-3</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

Legend:
2-Methylnaphthalene, 99% (gc)  

Revision Date 10-Feb-2015  

X - Listed  
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.  
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.  
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.  
P - Indicates a commenced PMN substance  
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.  
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule  
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.  
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).  
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.  
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.  

U.S. Federal Regulations  
TSCA 12(b)  
Not applicable  
SARA 313  
Not applicable  

SARA 311/312 Hazardous Categorization  
Acute Health Hazard  
Yes  
Chronic Health Hazard  
No  
Fire Hazard  
No  
Sudden Release of Pressure Hazard  
No  
Reactive Hazard  
No  

Clean Water Act  
Not applicable  
Clean Air Act  
Not applicable  

OSHA  
Occupational Safety and Health Administration  
Not applicable  

CERCLA  
Not applicable  

California Proposition 65  
This product does not contain any Proposition 65 chemicals  

State Right-to-Know  

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Methylnaphthalene</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation  

Reportable Quantity (RQ):  
N  
DOT Marine Pollutant  
N  
DOT Severe Marine Pollutant  
N  

U.S. Department of Homeland Security  
This product does not contain any DHS chemicals.  

Other International Regulations  

Mexico - Grade  
No information available  

Canada  
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR  

WHMIS Hazard Class  
D1B Toxic materials
16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date
10-Feb-2015

Print Date
10-Feb-2015

Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
   Product name : 4,4’-DDD
   Product Number : 35486
   Brand : Sigma-Aldrich
   CAS-No. : 72-54-8

1.2 Relevant identified uses of the substance or mixture and uses advised against
   Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet
   Company : Sigma-Aldrich
              3050 Spruce Street
              SAINT LOUIS MO  63103
              USA
   Telephone : +1 800-325-5832
   Fax : +1 800-325-5052

1.4 Emergency telephone number
   Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
   GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
   Acute toxicity, Oral (Category 3), H301
   Acute toxicity, Dermal (Category 4), H312
   Carcinogenicity (Category 2), H351
   Acute aquatic toxicity (Category 1), H400
   Chronic aquatic toxicity (Category 1), H410

   For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
   Pictogram
   Signal word : Danger
   Hazard statement(s)
   H301 : Toxic if swallowed.
   H312 : Harmful in contact with skin.
   H351 : Suspected of causing cancer.
   H410 : Very toxic to aquatic life with long lasting effects.

   Precautionary statement(s)
   P201 : Obtain special instructions before use.
   P202 : Do not handle until all safety precautions have been read and understood.
   P264 : Wash skin thoroughly after handling.
   P270 : Do not eat, drink or smoke when using this product.
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane TDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>(C_{14}H_{10}Cl_4)</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>320.04 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>72-54-8</td>
</tr>
<tr>
<td>EC-No.</td>
<td>200-783-0</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane</td>
<td>Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410</td>
<td>-</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas
Nature of decomposition products not known.

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Form: solid</td>
</tr>
<tr>
<td>Odour</td>
<td>no data available</td>
</tr>
<tr>
<td>Odour Threshold</td>
<td>no data available</td>
</tr>
<tr>
<td>pH</td>
<td>no data available</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>94.0 - 96.0 °C (201.2 - 204.8 °F)</td>
</tr>
<tr>
<td>Initial boiling point and boiling range</td>
<td>193.0 °C (379.4 °F) at 1.3 hPa (1.0 mmHg)</td>
</tr>
<tr>
<td>Flash point</td>
<td>no data available</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>no data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>no data available</td>
</tr>
<tr>
<td>Upper/lower flammability or explosive limits</td>
<td>no data available</td>
</tr>
<tr>
<td>Vapour pressure</td>
<td>&lt; 0.00001 hPa (&lt; 0.00001 mmHg) at 25.0 °C (77.0 °F)</td>
</tr>
<tr>
<td>Vapour density</td>
<td>no data available</td>
</tr>
<tr>
<td>Relative density</td>
<td>1.38 g/cm³</td>
</tr>
<tr>
<td>Water solubility</td>
<td>no data available</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>log Pow: 6.02</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>no data available</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>no data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>no data available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>no data available</td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>no data available</td>
</tr>
</tbody>
</table>

9.2 Other safety information
no data available
10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Hamster - > 5,000 mg/kg
TDLo Oral - Human - 428.5 mg/kg
Remarks: Endocrine:Adrenal cortex hypoplasia.

TDLo Oral - rat - 6,000 mg/kg

TDLo Oral - rat - 14 mg/kg

TDLo Oral - rat - 2,100 mg/kg
Remarks: Behavioral:Altered sleep time (including change in righting reflex).

Inhalation: no data available
LD50 Dermal - rabbit - 1,200 mg/kg
Remarks: Behavioral:Excitement. Behavioral:Convulsions or effect on seizure threshold. Skin irritation
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity
no data available

Carcinogenicity
This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.
Limited evidence of carcinogenicity in animal studies

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as
probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: KI0700000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish
LC50 - other fish - 1.18 - 9 mg/l - 96.0 h
LC50 - Lepomis macrochirus (Bluegill) - 0.04 - 0.05 mg/l - 96.0 h
LC50 - Oncorhynchus mykiss (rainbow trout) - 0.06 - 0.09 mg/l - 96.0 h
LC50 - Pimephales promelas (fathead minnow) - 3.47 - 5.58 mg/l - 96.0 h

Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia pulex (Water flea) - 0.01 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
Indication of bioaccumulation.

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.
Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2811  Class: 6.1  Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2811  Class: 6.1  Packing group: III  EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Marine pollutant: No

IATA
UN number: 2811  Class: 6.1  Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

15. REGULATORY INFORMATION

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>72-54-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>72-54-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>72-54-8</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

<table>
<thead>
<tr>
<th>Acute Tox.</th>
<th>Acute toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute</td>
<td>Acute aquatic toxicity</td>
</tr>
<tr>
<td>Aquatic Chronic</td>
<td>Chronic aquatic toxicity</td>
</tr>
<tr>
<td>Carc.</td>
<td>Carcinogenicity</td>
</tr>
<tr>
<td>H301</td>
<td>Toxic if swallowed.</td>
</tr>
<tr>
<td>H312</td>
<td>Harmful in contact with skin.</td>
</tr>
<tr>
<td>H351</td>
<td>Suspected of causing cancer.</td>
</tr>
<tr>
<td>H400</td>
<td>Very toxic to aquatic life.</td>
</tr>
<tr>
<td>H410</td>
<td>Very toxic to aquatic life with long lasting effects.</td>
</tr>
</tbody>
</table>
### HMIS Rating

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard</td>
<td>2</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td>*</td>
</tr>
<tr>
<td>Flammability</td>
<td>0</td>
</tr>
<tr>
<td>Physical Hazard</td>
<td>0</td>
</tr>
</tbody>
</table>

### NFPA Rating

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard</td>
<td>2</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>0</td>
</tr>
<tr>
<td>Reactivity Hazard</td>
<td>0</td>
</tr>
</tbody>
</table>

### Further information

Copyright 2014 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 5.1  
Revision Date: 06/26/2014  
Print Date: 05/11/2016
# 1. Identification

<table>
<thead>
<tr>
<th>Product Name</th>
<th>p-Cymene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat No.</td>
<td>AC111760000; AC111760010; AC111760025; AC111760100; AC111762500</td>
</tr>
<tr>
<td>Synonyms</td>
<td>Dolcymene; p-Isopropyltoluene</td>
</tr>
<tr>
<td>Recommended Use</td>
<td>Laboratory chemicals.</td>
</tr>
<tr>
<td>Uses advised against</td>
<td>No Information available</td>
</tr>
</tbody>
</table>

## 2. Hazard(s) identification

### Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable liquids</td>
<td>Category 3</td>
</tr>
<tr>
<td>Skin Corrosion/irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Target Organs - Respiratory system.</td>
<td></td>
</tr>
<tr>
<td>Aspiration Toxicity</td>
<td>Category 1</td>
</tr>
</tbody>
</table>

### Label Elements

**Signal Word**

Danger

**Hazard Statements**

- Flammable liquid and vapor
- May be fatal if swallowed and enters airways
- Causes skin irritation
- Causes serious eye irritation
- May cause respiratory irritation
Precautionary Statements

Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool

Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse

Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Do NOT induce vomiting

Fire
In case of fire: Use CO2, dry chemical, or foam for extinction

Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
None identified

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>99-87-6</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact
Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.

Inhalation
Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If
not breathing, give artificial respiration. Obtain medical attention.

Ingestion

Do not induce vomiting. Clean mouth with water. Get medical attention.

Most important symptoms/effects

Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Notes to Physician

Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media

Water spray. Carbon dioxide (CO\textsubscript{2}). Dry chemical. Use water spray to cool unopened containers. chemical foam.

Unsuitable Extinguishing Media

No information available

Flash Point Method -

47 °C / 116.6 °F

No information available

Autoignition Temperature

435 °C / 815 °F

Explosion Limits

Upper 5.60%

Lower .70%

Sensitivity to Mechanical Impact

No information available

Sensitivity to Static Discharge

No information available

Specific Hazards Arising from the Chemical

Flammable. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO\textsubscript{2})

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions

Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions

See Section 12 for additional ecological information.

Methods for Containment and Clean Up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling

Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Take precautionary measures against static discharges. Use explosion-proof equipment. Use only non-sparking tools.

Storage

Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat and sources of ignition. Flammables area.

8. Exposure controls / personal protection

Exposure Guidelines

This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Clear</td>
</tr>
<tr>
<td>Odor</td>
<td>aromatic</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>-68 °C / -90.4 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>176 - 178 °C / 348.8 - 352.4 °F @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>47 °C / 116.6 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>5.60%</td>
</tr>
<tr>
<td>Lower</td>
<td>.70%</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>1.5 mmHg @ 20 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>4.62 (Air = 1.0)</td>
</tr>
<tr>
<td>Relative Density</td>
<td>0.854</td>
</tr>
<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>435 °C / 815 °F</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No information available</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>C10 H14</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>134.22</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive Hazard</td>
<td>None known, based on information available</td>
</tr>
<tr>
<td>Stability</td>
<td>Stable under normal conditions.</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Incompatible products.</td>
</tr>
<tr>
<td>Incompatible Materials</td>
<td>Strong oxidizing agents, Strong acids, Strong bases</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>Carbon monoxide (CO), Carbon dioxide (CO₂)</td>
</tr>
<tr>
<td>Hazardous Polymerization</td>
<td>No information available.</td>
</tr>
<tr>
<td>Hazardous Reactions</td>
<td>None under normal processing.</td>
</tr>
</tbody>
</table>
11. Toxicological information

**Acute Toxicity**

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>3669 mg/kg (Rat)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation

No information available

Sensitization

No information available

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>99-87-6</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects

Not mutagenic in AMES Test

Reproductive Effects

No information available.

Developmental Effects

No information available.

Teratogenicity

No information available.

STOT - single exposure

Respiratory system

STOT - repeated exposure

None known

Aspiration hazard

No information available

Symptoms / effects, both acute and delayed

Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information

No information available

Other Adverse Effects

The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Do not empty into drains.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>Not listed</td>
<td>LC50: 48 mg/L/96h (sheepshead minnow)</td>
<td>Not listed</td>
<td>LC50: 6.5 mg/L/48h</td>
</tr>
</tbody>
</table>

Persistence and Degradability

Bioaccumulation / Accumulation

No information available.

Mobility

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>4.1</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.
14. Transport information

DOT
- UN-No: UN2046
- Hazard Class: 3
- Packing Group: III

TDG
- UN-No: UN2046
- Hazard Class: 3
- Packing Group: III

IATA
- UN-No: 2046
- Proper Shipping Name: CYMENES
- Hazard Class: 3
- Packing Group: III

IMDG/IMO
- UN-No: 2046
- Proper Shipping Name: CYMENES
- Hazard Class: 3
- Packing Group: III

15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>202-796-7</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- X - Listed
- E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
- F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
- N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
- P - Indicates a commenced PMN substance
- S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
- T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
- XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).
- Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
- Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)  Not applicable
SARA 313    Not applicable

SARA 311/312 Hazardous Categorization
- Acute Health Hazard: Yes
- Chronic Health Hazard: No
- Fire Hazard: Yes
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: No

Clean Water Act  Not applicable
Clean Air Act   Not applicable

OSHA Occupational Safety and Health Administration
Not applicable
CERCLA  
Not applicable

California Proposition 65  
This product does not contain any Proposition 65 chemicals

State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cymene</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

Reportable Quantity (RQ): N  
DOT Marine Pollutant: N  
DOT Severe Marine Pollutant: N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade  
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
- B2 Flammable liquid
- D2B Toxic materials

16. Other information

Prepared By  
Regulatory Affairs  
Thermo Fisher Scientific  
Email: EMSDS.RA@thermofisher.com

Revision Date  
10-Feb-2015

Print Date  
10-Feb-2015

Revision Summary  
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Acenaphthene
Product Number : 215376
Brand : Aldrich
CAS-No. : 83-32-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger

Hazard statement(s)
H315 : Causes skin irritation.
H319 : Causes serious eye irritation.
H335 : May cause respiratory irritation.
H350 : May cause cancer.
H410 : Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 : Obtain special instructions before use.
P202 : Do not handle until all safety precautions have been read and understood.
Aldrich - 215376

2.3 **Hazards not otherwise classified (HNOC) or not covered by GHS** - none

3. **COMPOSITION/INFORMATION ON INGREDIENTS**

3.1 **Substances**

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>1,8-Ethylene-naphthalene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>C$<em>{12}$H$</em>{10}$</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>154.21 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>83-32-9</td>
</tr>
<tr>
<td>EC-No.</td>
<td>201-469-6</td>
</tr>
</tbody>
</table>

**Hazardous components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>Skin Irrit. 2; Eye Irrit. 2A; Carc. 1B; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H315, H319, H335, H350, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. **FIRST AID MEASURES**

4.1 **Description of first aid measures**

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

**If swallowed**
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 **Most important symptoms and effects, both acute and delayed**
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.
4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance Form: solid
b) Odour No data available
c) Odour Threshold No data available
d) pH No data available
e) Melting point/freezing point Melting point/range: 90 - 94 °C (194 - 201 °F) - lit.
f) Initial boiling point and boiling range 279 °C (534 °F) - lit.
g) Flash point 125.0 °C (257.0 °F) - closed cup
h) Evaporation rate No data available
i) Flammability (solid, gas) No data available
j) Upper/lower flammability or explosive limits No data available
9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available
Inhalation: No data available
Dermal: No data available
LD50 Intraperitoneal - Rat - 600 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Acenaphthene)
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: Reasonably anticipated to be a human carcinogen (Acenaphthene)
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: AB1000000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
LC50 - Oncorhynchus mykiss (rainbow trout) - 0.67 mg/l - 96.0 h
LC50 - Pimephales promelas (fathead minnow) - 0.6 - 1.73 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 1.27 - 3.45 mg/l - 48 h
Toxicity to algae
EC50 - Pseudokirchneriella subcapitata (green algae) - 0.52 - 0.53 mg/l - 96 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential
Bioaccumulation
Lepomis macrochirus (Bluegill) - 28 d
- 0.00894 mg/l
Bioconcentration factor (BCF): 387

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.
Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077  Class: 9  Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Acenaphthene)
Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077  Class: 9  Packing group: III  EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Acenaphthene)
Marine pollutant: yes

IATA
UN number: 3077  Class: 9  Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Acenaphthene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

table

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

<table>
<thead>
<tr>
<th>Acute Acute</th>
<th>Aquatic toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Chronic</td>
<td>Chronic aquatic toxicity</td>
</tr>
<tr>
<td>Carc.</td>
<td>Carcinogenicity</td>
</tr>
<tr>
<td>Eye Irrit.</td>
<td>Eye irritation</td>
</tr>
<tr>
<td>H315</td>
<td>Causes skin irritation.</td>
</tr>
<tr>
<td>H319</td>
<td>Causes serious eye irritation.</td>
</tr>
<tr>
<td>H335</td>
<td>May cause respiratory irritation.</td>
</tr>
</tbody>
</table>
H350  May cause cancer.
H400  Very toxic to aquatic life.
H410  Very toxic to aquatic life with long lasting effects.

**HMIS Rating**
Health hazard: 0
Chronic Health Hazard: *
Flammability: 1
Physical Hazard 0

**NFPA Rating**
Health hazard: 0
Fire Hazard: 1
Reactivity Hazard: 0

**Further information**
Copyright 2014 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

**Preparation Information**
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4  Revision Date: 01/02/2015  Print Date: 12/11/2015
SAFETY DATA SHEET

Revision Date 10-Feb-2015
Revision Number 1

1. Identification

Product Name Poly(acenaphthylene)
Cat No. : AC178020000; AC178020050; AC178020100
Synonyms None.
Recommended Use Laboratory chemicals.
Uses advised against No Information available

Company Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100
Entity / Business Name Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410
Emergency Telephone Number For information US call: 001-800-ACROS-01
Europe call: +32 14 57 52 11
Emergency Number US:001-201-796-7100 /
Europe: +32 14 57 52 99
CHEMTREC Tel. No.US:001-800-424-9300 /
Europe:001-703-527-3887

2. Hazard(s) identification


Based on available data, the classification criteria are not met

Label Elements None required

Hazards not otherwise classified (HNOC) None identified
Unknown Acute Toxicity .? % of the mixture consists of ingredients of unknown toxicity.

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly(acenaphthylene)</td>
<td>25036-01-5</td>
<td>100</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated
Poly(acenaphthylene)

Inhalation
Remove from exposure, lie down. Move to fresh air.

Ingestion
Do not induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If possible drink milk afterwards.

Most important symptoms/effects
No information available.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media
Water spray. Carbon dioxide (CO₂). Dry chemical. alcohol-resistant foam.

Unsuitable Extinguishing Media
No information available

Flash Point
No information available

Method -
No information available

Autoignition Temperature
No information available

Explosion Limits
Upper
No data available

Lower
No data available

Sensitivity to Mechanical Impact
No information available

Sensitivity to Static Discharge
No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Thermal decomposition can lead to release of irritating gases and vapors. Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions
See Section 12 for additional ecological information.

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal.

7. Handling and storage

Handling
Avoid contact with skin and eyes. Avoid contact with clothing. Remove and wash contaminated clothing before re-use. Avoid breathing vapors or mists. Do not ingest. Wash thoroughly after handling.

Storage
Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines
This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Powder Solid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No information available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Relative Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No information available</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive Hazard</td>
<td>None known, based on information available</td>
</tr>
<tr>
<td>Stability</td>
<td>Stable under normal conditions.</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>Incompatible products.</td>
</tr>
<tr>
<td>Incompatible Materials</td>
<td>Oxidizing agents</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>Thermal decomposition can lead to release of irritating gases and vapors, Carbon monoxide (CO), Carbon dioxide (CO₂)</td>
</tr>
<tr>
<td>Hazardous Polymerization</td>
<td>No information available.</td>
</tr>
<tr>
<td>Hazardous Reactions</td>
<td>None under normal processing.</td>
</tr>
</tbody>
</table>

11. Toxicological information

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Toxicity</td>
<td>No acute toxicity information is available for this product</td>
</tr>
<tr>
<td>Product Information</td>
<td>No acute toxicity information is available for this product</td>
</tr>
</tbody>
</table>
Poly(acenaphthylene)  
Revision Date 10-Feb-2015

Oral LD50  
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50  
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Mist LC50  
Based on ATE data, the classification criteria are not met. ATE > 5 mg/l.

Component Information  

Toxicologically Synergistic Products  
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure  

Irritation  
No information available

Sensitization  
No information available

Carcinogenicity  
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly(acenaphthylene)</td>
<td>25036-01-5</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects  
No information available

Reproductive Effects  
No information available.

Developmental Effects  
No information available.

Teratogenicity  
No information available.

STOT - single exposure  
None known

STOT - repeated exposure  
None known

Aspiration hazard  
No information available

Symptoms / effects, both acute and delayed  
No information available

Endocrine Disruptor Information  
No information available

Other Adverse Effects  
The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity  
Do not empty into drains.

Persistence and Degradability  
No information available

Bioaccumulation/ Accumulation  
No information available

Mobility  
No information available

13. Disposal considerations

Waste Disposal Methods  
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT  
Not regulated

TDG  
Not regulated

IATA  
Not regulated

IMDG/IMO  
Not regulated

15. Regulatory information

International Inventories
Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable
SARA 313 Not applicable

SARA 311/312 Hazardous Categorization
- Acute Health Hazard No
- Chronic Health Hazard No
- Fire Hazard No
- Sudden Release of Pressure Hazard No
- Reactive Hazard No

Clean Water Act Not applicable
Clean Air Act Not applicable
OSHA Occupational Safety and Health Administration Not applicable
CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals
State Right-to-Know Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class Non-controlled
16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date 10-Feb-2015
Print Date 10-Feb-2015
Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone
Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808
CAS#: 67-64-1
RTECS: AL3150000
TSCA: TSCA 8(b) inventory: Acetone
CI#: Not applicable.
Synonym: 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid
Chemical Name: Acetone
Chemical Formula: C3-H6-O

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>67-64-1</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat], 3000 mg/kg [Mouse], 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat], 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures
Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

---

**Section 5: Fire and Explosion Data**

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 465°C (869°F)

**Flash Points:**
- CLOSED CUP: -20°C (-4°F).
- OPEN CUP: -9°C (15.8°F) (Cleveland).

**Flammable Limits:**
- LOWER: 2.6%
- UPPER: 12.8%

**Products of Combustion:** These products are carbon oxides (CO, CO2).

**Fire Hazards in Presence of Various Substances:** Highly flammable in presence of open flames and sparks, of heat.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

**Fire Fighting Media and Instructions:**
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

**Special Remarks on Fire Hazards:** Vapor may travel considerable distance to source of ignition and flash back.

**Special Remarks on Explosion Hazards:**
Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

---

**Section 6: Accidental Release Measures**

**Small Spill:**
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.
Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:
Store in a segregated and approved area (flammables area). Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Australia] TWA: 1185 STEL: 2375 (mg/m3) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.
Odor: Fruity, Mint-like, Fragrant, Ethereal
Taste: Pungent, Sweetish
Molecular Weight: 58.08 g/mole
Color: Colorless, Clear
pH (1% soln/water): Not available.
Boiling Point: 56.2°C (133.2°F)
Melting Point: -95.35 (-139.6°F)
Critical Temperature: 235°C (455°F)
Specific Gravity: 0.79 (Water = 1)
Vapor Pressure: 24 kPa (@ 20°C)
Vapor Density: 2 (Air = 1)
Volatile: Not available.
Odor Threshold: 62 ppm
Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2
Ionicity (in Water): Not available.
Dispersion Properties: See solubility in water.
Solubility: Easily soluble in cold water, hot water.

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

**Incompatibility with various substances:** Reactive with oxidizing agents, reducing agents, acids, alkalis.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

### Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3000 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

**Other Toxic Effects on Humans:**
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**
May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects: Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizziness, drowsiness, confusion, headache, muscle weakness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting). Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also
affect the Central Nervous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis. Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fathead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde Connecticut hazardous material survey.: Acetone Illinois toxic substances disclosure to employee act: Acetone Illinois chemical safety act: Acetone New York release reporting list: Acetone Rhode Island RTK hazardous substances: Acetone Pennsylvania RTK: Acetone Florida: Acetone Minnesota: Acetone Massachusetts RTK: Acetone Massachusetts spill list: Acetone New Jersey: Acetone New Jersey spill list: Acetone Louisiana spill reporting: Acetone California List of Hazardous Substances (8 CCR 339): Acetone TSCA 8(b) inventory: Acetone TSCA 4(a) final test rules: Acetone TSCA 8(a) IUR: Acetone

Other Regulations:

Other Classifications:
WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).
DSCL (EEC):
R11- Highly flammable. R36- Irritating to eyes. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2
Fire Hazard: 3
Reactivity: 0
Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1
Flammability: 3
Reactivity: 0
Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

### Section 16: Other Information

**References:**
- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
- LOKI, RTECS, HSDB databases. Other MSDSs

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:13 PM

**Last Updated:** 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
1. Identification

Product identifier: ATOMIZED ALUMINUM POWDER

Other means of identification:
- SDS number: 123
- Chemical formula: Al
- Version #: 08
- Revision date: August 11, 2015.

Other means of identification:
- Synonyms: All non-alloyed, non-coated nodular aluminum powder containing < 1% trace elements * Grade 13, 101, 102, 104, 101T, 120, 121, 123, 1124, 1202, 1233, 1235, 1401/S2(1406), 1403, 1404, 1407, 1401/S9(1409), 1125, * 4402, 6401, 7123, 7124, 7125, 7401

Recommended use:
Various metallurgical/chemical/structural/coating applications

Recommended restrictions:
None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer:
- Alcoa Inc.
  - 201 Isabella Street
  - Pittsburgh, PA USA 15212
  - Health and Safety Tel: +1-412-553-4649
  - Health and Safety Fax: +1-412-553-4822
  - Health and Safety Email: accmsds@alcoa.com

- Alcoa Inc.
  - Rockdale Operations
  - P.O. Box 472
  - Rockdale, TX 76567
  - Tel: +1-512-446-8681

- Poços de Caldas
  - Rodovia Poços de Caldas/Andradas, km 10
  - CEP 37.719-900
  - Poços de Caldas, Minas Gerais
  - Tel.: (+55 35) 2101-5000
  - E-mail: pfacomercialprimarios@alcoa.com.br

Emergency Information:
CHEMTREC: +1-703-527-3887 +1-800-424-9300 (24 Hour Emergency Telephone, multiple languages spoken); ALCOA: +1-412-553-4001 (24 Hour Emergency Telephone, only English spoken)

Website:
For a current Safety Data Sheet, refer to Alcoa websites: www.alcoa.com or internally at my.alcoa.com EHS Community

2. Hazard(s) identification

Physical hazards:
Not classified.

Health hazards:
Not classified.

Environmental hazards:
Not classified.

Authority defined hazards:
Combustible dust

Label elements:
- Hazard symbol:
  - None.
- Signal word:
  - Warning
- Hazard statement:
  - May form combustible dust concentrations in air.
Precautionary statement

Prevention
Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Use only non-sparking tools and natural bristle brushes. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Prevent dust accumulation to minimize explosion hazard. Take precautionary measures against static discharge.

Response
In case of fire: Use appropriate media for extinction.

Storage
Store in a dry place and/or in closed container. Keep away from heat, sparks and open flame - No smoking. Do not allow chips, fines or dust to contact water, particularly in enclosed areas.

Disposal
Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal.

Hazard(s) not otherwise classified (HNOC)
None known.

Supplemental information
Powder may ignite readily. Powder or dusts dispersed in the air can be explosive.

Explosion/fire hazards may be present when:
• Powder or dust are dispersed in air.
• Powder or dusts are in contact with water.
• Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).

3. Composition/information on ingredients

Composition comments
Complete composition is provided below and may include some components classified as non-hazardous.

Substances

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum powder</td>
<td></td>
<td>7429-90-5</td>
<td>≥99.7</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye contact
Dust from processing: Rinse eyes with plenty of water or saline for at least 15 minutes. Consult a physician.

Skin contact
Dust from processing: Wash with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Inhalation
Dust from processing: Remove to fresh air. Check for clear airway, breathing, and presence of pulse. If breathing is difficult, provide oxygen. Loosen any tight clothing on neck or chest. Provide cardiopulmonary resuscitation for persons without pulse or respirations. Consult a physician.

Ingestion
If swallowed, dilute by drinking water. Recommend quantities up to 30 mL (~1 oz.) in children and 250 mL (~9 oz.) in adults. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do NOT induce vomiting. Consult a physician.

Most important symptoms/effects, acute and delayed
Dust from processing: Can cause irritation of the upper respiratory tract. See Section 11 of the SDS for additional information on health hazards.

Medical conditions aggravated by exposure
Asthma, chronic lung disease, and skin rashes.

Indication of immediate medical attention and special treatment needed
Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen.

General information
If exposed or concerned: Get medical advice/attention. In case of shortness of breath, give oxygen.

5. Fire-fighting measures

Suitable extinguishing media
Use Class D extinguishing agents on fines, dust or molten metal.

Unsuitable extinguishing media
DO NOT USE water, halogenated agents, or ABC dry chemical agents. These fire extinguishing agents will react with the burning material.
Alcoa aluminum powders were tested by the United States Department of Interior Bureau of Mines in 1991, under UN criteria and found not to meet the definition of a hazard class 4. Care should be taken, however, during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles.

May be a potential hazard under the following conditions:
- Dust clouds may be explosive. Even a minor dust cloud can explode violently. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions.
- Powder or dusts in contact with water can generate flammable/explosive hydrogen gas. These gases could present an explosion hazard in confined or poorly ventilated spaces.
- Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).

Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

Use gentle surface application of Class D extinguishing agent or dry inert granular material (e.g., sand) to cover and ring the burning material. Avoid mixing of the extinguishing agent with the burning material. Apply extinguishing media carefully to avoid creating airborne dust. Do not disturb the material until completely cool. If possible, isolate the burning material to prevent fire spread, and allow the material to burn itself out. Move undamaged containers away from heat or flame, if possible.

Obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin F-1 and National Fire Protection Association (NFPA) Standards listed in Section 16.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures
Avoid contact with skin and eyes. Use personal protection recommended in Section 8 of the SDS.

Personal precautions, protective equipment and emergency procedures
Avoid contact with skin and eyes. Use personal protection recommended in Section 8 of the SDS.

For emergency responders
Keep people away from and upwind of spill/leak. Keep unnecessary personnel away.

Evacuation procedures
Isolate area. Avoid the generation of dusts during clean-up. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Use only non-sparking tools and natural bristle brushes. Use dry cleanup procedures.

Methods and materials for containment and cleaning up
Keep material dry. Place carefully in dry, water-tight containers. Seal containers. After complete clean-up by sweeping, area may be washed with large amounts of water if necessary. Material that cannot be reclaimed may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal. For waste disposal, see section 13 of the SDS.

Environmental precautions
No specific precautions.

7. Handling and storage

Handling
Keep away from sources of ignition - No smoking. Avoid contact with skin and eyes. Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Keep material dry.

Storage
Keep dry. Storage rooms must be of fire-resistant construction. Do not store powder in same room as other combustible materials.
Obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin TR-2 and National Fire Protection Association (NFPA) brochures listed in Section 16. Use non-sparking handling equipment, tools and natural bristle brush. Cover and reseal partially empty containers. Provide grounding and bonding where necessary to prevent accumulation of static charges during metal dust handling and transfer operations (See Section 15).

Local ventilation and vacuum systems must be designed to handle explosive dusts. Dry vacuums and electrostatic precipitators must not be used, unless specifically approved for use with flammable/explosive dusts. Dust collection systems must be dedicated to aluminum dust only and should be clearly labeled as such. Do not co-mingle fines of aluminum with fines of iron, iron oxide (rust) or other metal oxides.

Process equipment, storage containers, vessels and buildings should be equipped with explosion/pressure relief valves, panels and windows. Precautions must also be taken to prevent water leakage or seepage which could contact the powder. Refer to NFPA 484.

Avoid all ignition sources. Good housekeeping practices must be maintained. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions. Do not use compressed air to remove settled material from floors, beams or equipment. Do not allow fines or dust to contact water, particularly in enclosed areas.

### 8. Exposure controls/personal protection

#### Occupational exposure limits

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum powder (CAS 7429-90-5)</td>
<td>TWA</td>
<td>15 mg/m³</td>
<td>(total dust)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATOMIZED ALUMINUM POWDER</td>
<td>PEL</td>
<td>5 mg/m³</td>
<td>Respirable dust.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 mg/m³</td>
<td>Total dust.</td>
</tr>
<tr>
<td>Aluminum powder (CAS 7429-90-5)</td>
<td>TWA</td>
<td>5 mg/m³</td>
<td>Respirable dust.</td>
</tr>
</tbody>
</table>

#### US ACGIH Threshold Limit Values: Time Weighted Average (TWA): mg/m³, non-standard units

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATOMIZED ALUMINUM POWDER</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>Respirable fraction.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alcoa Material</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATOMIZED ALUMINUM POWDER</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Respirable fraction.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum powder (CAS 7429-90-5)</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Respirable fraction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mg/m³</td>
<td>Total dust.</td>
</tr>
</tbody>
</table>

#### General

Use personal protective equipment as required.

#### Appropriate engineering controls

Dust from processing: Use with adequate explosion-proof ventilation designed to handle particulates to meet the limits listed in Section 8, Exposure Guidelines.

#### Individual protection measures, such as personal protective equipment

- **Eye/face protection**: Wear safety glasses with side shields.
- **Skin protection**: Wear impervious gloves to avoid direct skin contact.
- **Hand protection**:
Other

Recommend fire resistant cotton or equivalent full-length fire resistant pants and jackets along with electrically conductive safety shoes or grounding straps. Great caution is required to avoid contact with unprotected electrical devices when wearing conductive safety shoes or grounding straps.

Respiratory protection

Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 8. Suggested respiratory protection: N95.

General considerations

Handle in accordance with good industrial hygiene and safety practice. When using, do not eat, drink or smoke. Wash hands before breaks and immediately after handling the product.

Respiratory protection

Not applicable.

Thermal hazards

Not applicable.

9. Physical and chemical properties

Form
Solid, powder.

Color
Silvery to gray.

Odor
Odorless

Odor threshold
Not applicable

pH
Not applicable

Density
0.80 - 1.30 g/cm³

Melting point/freezing point
1194.8 - 1214.6 °F (646 - 657 °C)
1220 °F (660 °C)

Initial boiling point and boiling range
Not determined

4220.6 °F (2327 °C)

Flash point
Not applicable

Evaporation rate
Not applicable

Flammability (solid, gas)
Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - upper (%)
Not determined

Flammability limit - lower (%)
40 mg/l

Explosive properties

Dust can form an explosive mixture in air. Dust accumulation from this product may present an explosion hazard in the presence of an ignition source.

Dust explosion properties

St class
Very strong explosion.

Vapor pressure
Not applicable

Vapor density
Not applicable

Relative density
Not determined

Solubility(ies)
Insoluble

Partition coefficient (n-octanol/water)
Not applicable.

Auto-ignition temperature
1202 °F (650 °C) layered

Decomposition temperature
Not applicable

Viscosity
Not applicable

10. Stability and reactivity

Reactivity
The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability
Stable under normal conditions of use, storage, and transportation as shipped.

Possibility of hazardous reactions
Hazardous polymerization does not occur.

Conditions to avoid

• Water: Slowly generates flammable and explosive hydrogen gas and heat. Generation rate is greatly increased with smaller particles (e.g., fines and dusts). Water/aluminum mixtures may be hazardous when confined.
• Heat: Oxidizes at a rate dependent upon temperature and particle size.
Incompatible materials

- Acids and alkalis: Reacts to generate flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles (e.g., fines and dusts).
- Strong oxidizers: Violent reaction with considerable heat generation. Can react explosively with nitrates (e.g., ammonium nitrate and fertilizers containing nitrate) when heated or molten.
- Halogenated compounds: Many halogenated hydrocarbons, including halogenated fire extinguishing agents, can react violently with finely divided or molten aluminum.
- Iron oxide (rust) and other metal oxides (e.g., copper and lead oxides): A violent thermite reaction generating considerable heat can occur. Reaction with aluminum fines and dusts requires only very weak ignition sources for initiation.
- Iron powder and water: Explosive reaction forming hydrogen gas when heated above 1470°F (800°C).

Hazardous decomposition products

No hazardous decomposition products are known.

11. Toxicological information

Health effects associated with ingredients

Aluminum dust/fines and fumes: Low health risk by inhalation. Generally considered to be biologically inert.

Health effects associated with compounds formed during processing

No new/additional compounds are expected to be formed during processing.

Information on likely routes of exposure

- **Eye contact**: Can cause mechanical irritation.
- **Skin contact**: Dust from processing: Can cause mechanical irritation.
- **Inhalation**: Dust from processing: Can cause irritation of the upper respiratory tract.
- **Ingestion**: Can cause irritation of the gastrointestinal tract.

Symptoms related to the physical, chemical and toxicological characteristics

Dust from processing: Can cause mechanical irritation. Dust: Can cause irritation of the upper respiratory tract.

Information on toxicological effects

- **Acute toxicity**: Based on available data, the classification criteria are not met.
- **Skin corrosion/irritation**: Non-corrosive.
- **Serious eye damage/eye irritation**: Can cause mechanical irritation.
- **Respiratory or skin sensitization**: Not a respiratory sensitizer.
- **Skin sensitization**: Not a skin sensitizer.
- **Germ cell mutagenicity**: Based on available data, the classification criteria are not met.
- **Neurological effects**: Based on available data, the classification criteria are not met.
- **Pre-existing conditions aggravated by exposure**: Asthma, chronic lung disease, and skin rashes.
- **Carcinogenicity**: Does not present any cancer hazards.
- **Reproductive toxicity**: Does not present any reproductive hazards.
- **Routes of exposure**: Inhalation. Skin contact. Eye contact.
- **Specific target organ toxicity - single exposure**: Based on available data, the classification criteria are not met.
- **Specific target organ toxicity - repeated exposure**: Based on available data, the classification criteria are not met.
- **Aspiration hazard**: Not an aspiration hazard.
- **Chronic effects**: Not classified.
- **Further information**: None known.

12. Ecological information

Ecotoxicity

Not expected to be harmful to aquatic organisms.
Product Test Results

Species: Aquatic

**ATOMIZED ALUMINUM POWDER**

<table>
<thead>
<tr>
<th>Fish</th>
<th>LC50</th>
<th>Rainbow trout, donaldson trout (Oncorhynchus mykiss)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.16 mg/l, 96 hours</td>
</tr>
</tbody>
</table>

**Persistence and degradability**
The product is not biodegradable.

**Bioaccumulative potential**
The product does not contain any substances expected to be bioaccumulating.

**Mobility in soil**
Not considered mobile.

**Mobility in general**
Not considered mobile.

**Other adverse effects**
Not available.

13. **Disposal considerations**

**Disposal instructions**
Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal.

**Local disposal regulations**
Dispose in accordance with all applicable regulations.

**Waste codes**
RCRA Status: Not federally regulated in the U.S. if disposed of "as is."
RCRA waste codes other than described here may apply depending on use of the product. Status must be determined at the point of waste generation. Refer to 40 CFR 261 or state equivalent in the U.S.

**Waste from residues / unused products**
If reuse or recycling is not possible, disposal must be made according to local or governmental regulations.

**Contaminated packaging**
Dispose of in accordance with local regulations.

14. **Transport information**

**General Shipping Information**

**Basic Shipping Information**

- ID number
- Proper shipping name: Not regulated
- Hazard class
- Packing group

**General Shipping Notes**
- This material has been tested under UN criteria and found not to meet the definition of a hazard class 4 and does not meet the definition of any other hazard class.
- HTS (Harmonized Tariff Schedule) code: 7603.10.0000.
- The import/export HTS (Harmonized Tariff Schedule) code given above is the United States HTS code provided by Alcoa’s Customs Compliance Office in Knoxville, TN. Other country specific HTS codes may apply. If available, more information on the HTS codes will be provided on country specific Material Safety Data Sheets.
- When "Not regulated", enter the proper freight classification, SDS Number and Product Name onto the shipping paperwork.

**Disclaimer**
This section provides basic classification information and, where relevant, information with respect to specific modal regulations, environmental hazards and special precautions. Otherwise, it is presumed that the information is not available/not relevant

15. **Regulatory information**

**US federal regulations**
In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.
All electrical equipment must be suitable for use in hazardous atmospheres involving aluminum powder in accordance with 29 CFR 1910.307. The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installation which will meet this requirement.

**TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**
Not regulated.

**CERCLA Hazardous Substance List (40 CFR 302.4)**
Not listed.
Material name: ATOMIZED ALUMINUM POWDER

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 hazard categories
- Immediate Hazard - No
- Delayed Hazard - No
- Fire Hazard - No
- Pressure Hazard - Yes
- Reactivity Hazard - No

If dust clouds are generated

SARA 302 Extremely hazardous substance
Not listed.

SARA 311/312 Hazardous chemical
Yes

SARA 313 (TRI reporting)

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>CAS number</th>
<th>% by wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum powder</td>
<td>7429-90-5</td>
<td>≥99.7</td>
</tr>
</tbody>
</table>

US state regulations
US. California Proposition 65
Not Listed.

International Inventories

<table>
<thead>
<tr>
<th>Country(s) or region</th>
<th>Inventory name</th>
<th>On inventory (yes/no)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Domestic Substances List (DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Non-Domestic Substances List (NDSL)</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European Inventory of Existing Commercial Chemical Substances (EINECS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European List of Notified Chemical Substances (ELINCS)</td>
<td>No</td>
</tr>
<tr>
<td>Japan</td>
<td>Inventory of Existing and New Chemical Substances (ENCS)</td>
<td>No</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals List (ECL)</td>
<td>Yes</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Inventory</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>United States &amp; Puerto Rico</td>
<td>Toxic Substances Control Act (TSCA) Inventory</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*“Yes” indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
“A “No” indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

SDS Status
August 11, 2015: Change(s) in Section: 1 and 16.
April 30, 2015 (April 30, 2015 Minor modification 0123usa): Change(s) in Section: 1, 2 Minor modification...
January 7, 2015: Change(s) in Section: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16.

Origination date: September 17, 1980

Hazardous Materials Control Committee
Preparer: Jim Perriello, +1-865-977-2051.

SDS System Number: 145308

Revision date
August 11, 2015.

Version #
08

Revision Information
Product and Company Identification: Synonyms
Composition / Information on Ingredients: Disclosure Overrides
Physical & Chemical Properties: Multiple Properties
Transport Information: Agency Name, Packaging Type, and Transport Mode Selection
Regulatory Information: United States
HazReg Data: North America
GHS: Classification

Disclaimer
The information in the sheet was written based on the best knowledge and experience currently available.
Other information

- NFPA 484, Standard for Combustible Metals (NFPA phone: 800-344-3555)
- NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 70, Standard for National Electrical Code (Electrical Equipment, Grounding and Bonding)
- NFPA 77, Standard for Static Electricity
- NFPA 68, Standard on Explosion Protection by Deflagration Venting • NFPA 69, Standard on Explosion Prevention Systems

Key/Legend:

ACGIH: American Conference of Governmental Industrial Hygienists
AICS: Australian Inventory of Chemical Substances
CAS: Chemical Abstract Services
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFR: Code of Federal Regulations
CPR: Cardio-pulmonary Resuscitation
DOT: Department of Transportation
DSL: Domestic Substances List (Canada)
EC: Effective Concentration
ED: Effective Dose
EINECS: European Inventory of Existing Commercial Chemical Substances
ENCS: Japan - Existing and New Chemical Substances
EWC: European Waste Catalogue
EPA: Environmental Protective Agency
IARC: International Agency for Research on Cancer
LC: Lethal Concentration
LD: Lethal Dose
MAK: Maximum Workplace Concentration (Germany) "maximale Arbeitsplatz-Konzentration"
NDSL: Non-Domestic Substances List (Canada)
NIOSH: National Institute for Occupational Safety and Health
NTP: National Toxicology Program
OEL: Occupational Exposure Limit
OSHA: Occupational Safety and Health Administration
PIN: Product Identification Number
PMCC: Pensky Marten Closed Cup
RCRA: Resource Conservation and Recovery Act
SARA: Superfund Amendments and Reauthorization Act
SIMDUT: Système d’Information sur les Matières Dangereuses Utilisées au Travail
STEL: Short Term Exposure Limit
TCLP: Toxic Chemicals Leachate Program
TDG: Transportation of Dangerous Goods
TLV: Threshold Limit Value
TSCA: Toxic Substances Control Act
TWA: Time Weighted Average
WHMIS: Workplace Hazardous Materials Information System

m: meter, cm: centimeter, mm: millimeter, in: inch,
g: gram, kg: kilogram, lb: pound, µg: microgram,
ppm: parts per million, ft: feet

*** End of SDS ***
**Hazard statement**
May form combustible dust concentrations in air.

**Precautionary statement**

**Prevention**
Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Use only non-sparking tools and natural bristle brushes. Keep away from heat/sparks/open flames/hot surfaces - No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Prevent dust accumulation to minimize explosion hazard. Take precautionary measures against static discharge.

**Response**
In case of fire: Use appropriate media for extinction.

**Storage**
Store in a dry place and/or in closed container. Keep away from heat, sparks and open flame - No smoking. Do not allow chips, fines or dust to contact water, particularly in enclosed areas.

**Disposal**
Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal.

**Warning**

**Supplemental information**
Powder may ignite readily. Powder or dusts dispersed in the air can be explosive.

Explosion/fire hazards may be present when:
• Powder or dust are dispersed in air.
• Powder or dusts are in contact with water.
• Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).

**FIRE FIGHTING MEASURES:** Use gentle surface application of Class D extinguishing agent or dry inert granular material (e.g., sand) to cover and ring the burning material. Avoid mixing of the extinguishing agent with the burning material. If possible, isolate the burning material to prevent fire spread, and allow the material to burn itself out. Do not disturb the material until completely cool. Move undamaged containers away from heat or flame, if possible.

DO NOT USE water, halogenated agents, or ABC dry chemical agents. These fire extinguishing agents will react with the burning material.

**IN CASE OF SPILL:** Avoid dusting of powder to the greatest extent possible. Use only non-sparking tools and natural bristle brushes. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Prohibit smoking. Use dry cleanup procedures. Place carefully in dry, water-tight containers. Seal containers. After complete clean-up by sweeping, area may be washed with large amounts of water if necessary.

See Alcoa SDS Number 0123.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

- **Product name**: Anthracene
- **Product Number**: A89200
- **Brand**: Aldrich
- **CAS-No.**: 120-12-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

- **Identified uses**: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

- **Company**: Sigma-Aldrich
- 3050 Spruce Street
- SAINT LOUIS MO  63103
- USA
- **Telephone**: +1 800-325-5832
- **Fax**: +1 800-325-5052

1.4 Emergency telephone number

- **Emergency Phone #**: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

**GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

- Skin irritation (Category 2), H315
- Eye irritation (Category 2A), H319
- Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
- Acute aquatic toxicity (Category 1), H400
- Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

**Pictogram**

![Pictogram](image)

**Signal word**: Warning

**Hazard statement(s)**

- H315: Causes skin irritation.
- H319: Causes serious eye irritation.
- H335: May cause respiratory irritation.
- H410: Very toxic to aquatic life with long lasting effects.

**Precautionary statement(s)**

- **P261**: Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
- **P264**: Wash skin thoroughly after handling.
- **P271**: Use only outdoors or in a well-ventilated area.
- **P273**: Avoid release to the environment.
- **P280**: Wear eye protection/ face protection.
P280 Wear protective gloves.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313 If skin irritation occurs: Get medical advice/attention.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
Photosensitizer., Lachrymator.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula: $C_{14}H_{10}$
Molecular weight: 178.23 g/mol
CAS-No.: 120-12-7
EC-No.: 204-371-1

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H315, H319, H335, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>TWA</td>
<td>0.200000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>Remarks</td>
<td>1910.1002</td>
<td></td>
<td></td>
<td>As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen</td>
</tr>
</tbody>
</table>
Potential Occupational Carcinogen
NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products.
cyclohexane-extractable fraction
See Appendix C
See Appendix A

### Biological occupational exposure limits

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>1-Hydroxypyrene (1-HP)</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**
End of shift at end of workweek

### 8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Full contact**
Material: Chloroprene
Minimum layer thickness: 0.6 mm
Break through time: 480 min
Material tested: Campren® (KCL 722 / Aldrich Z677493, Size M)

**Splash contact**
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 30 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: crystalline
   Colour: beige

b) Odour
   No data available

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: 210 - 215 °C (410 - 419 °F) - lit.

f) Initial boiling point and boiling range
   340 °C (644 °F) - lit.

g) Flash point
   No data available

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   Lower explosion limit: 0.6 %(V)

k) Vapour pressure
   1.3 hPa (1.0 mmHg) at 145.0 °C (293.0 °F)

l) Vapour density
   No data available

m) Relative density
   No data available

n) Water solubility
   No data available

o) Partition coefficient: n-octanol/water
   log Pow: 4.45

p) Auto-ignition temperature
   540.0 °C (1,004.0 °F)

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information
   No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   No data available

10.4 Conditions to avoid
   No data available

10.5 Incompatible materials
   Strong oxidizing agents, Hypochlorites

10.6 Hazardous decomposition products
   Other decomposition products - No data available
11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

**Acute toxicity**
Inhalation: No data available
Dermal: No data available
LD50 Intraperitoneal - Mouse - 430 mg/kg

**Skin corrosion/irritation**
Skin - Mouse
Result: Mild skin irritation

**Serious eye damage/eye irritation**
Irritating to eyes. The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

**Respiratory or skin sensitisation**
Causes photosensitivity. Exposure to light can result in allergic reactions resulting in dermatologic lesions, which can vary from sunburnlike responses to edematous, vesiculated lesions, or bullae

**Germ cell mutagenicity**
No data available

**Carcinogenicity**
IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Anthracene)
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: OSHA specifically regulated carcinogen (Anthracene)

**Reproductive toxicity**
No data available

**Specific target organ toxicity - single exposure**
Inhalation - May cause respiratory irritation.
The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**
RTECS: CA9350000
Possible tumor promoter., Headache, Nausea, Weakness
Blood -

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - Lepomis macrochirus (Bluegill) - 0.001 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 0.10 mg/l - 48 h
12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Indication of bioaccumulation.
Bioaccumulation Pimephales promelas (fathead minnow) - 42 d
- 0.01191 mg/l

Bioconcentration factor (BCF): 649

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Anthracene)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Anthracene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Anthracene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard
### Massachusetts Right To Know Components

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<td>2007-07-01</td>
</tr>
</tbody>
</table>

### Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
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</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

### New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

### California Prop. 65 Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

**WARNING!** This product contains a chemical known to the State of California to cause cancer.

### 16. OTHER INFORMATION

**Full text of H-Statements referred to under sections 2 and 3.**

- **Aquatic Acute**
  - Acute aquatic toxicity
- **Aquatic Chronic**
  - Chronic aquatic toxicity
- **Eye Irrit.**
  - Eye irritation
- **H315**
  - Causes skin irritation.
- **H319**
  - Causes serious eye irritation.
- **H335**
  - May cause respiratory irritation.
- **H400**
  - Very toxic to aquatic life.
- **H410**
  - Very toxic to aquatic life with long lasting effects.

**HMIS Rating**

- Health hazard: 2
- Chronic Health Hazard: 0
- Flammability: 0
- Physical Hazard: 0

**NFPA Rating**

- Health hazard: 2
- Fire Hazard: 0
- Reactivity Hazard: 0

**Further information**

Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See [www.sigma-aldrich.com](http://www.sigma-aldrich.com) and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

**Preparation Information**

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.9   Revision Date: 04/20/2015   Print Date: 12/11/2015
Antimony
Safety Data Sheet
according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations
Revision Date: 02/12/2014

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY

1.1. Product Identifier
Product Form: Substance
Product Name: Antimony
Synonyms: Stibium (Sb)

1.2. Intended Use of the Product  No additional information available

1.3. Name, Address, and Telephone of the Responsible Party
Company
Atomized Products Group, Inc
3838 Miller Park Dr
Garland, TX 75042
T 972-272-9596
atomizedproductsgroup.com

1.4. Emergency Telephone Number
Emergency Number : 800-255-3924 (CHEMTEL)

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the Substance or Mixture
Classification (GHS-US)
Comb. Dust
Acute Tox. 3 (Oral)  H301
Acute Tox. 4  H332
(Inhalation:dust,mist)
Carc. 2  H351
Aquatic Acute 2  H401
Aquatic Chronic 2  H411

2.2. Label Elements
GHS-US Labeling
Hazard Pictograms (GHS-US): 

Signal Word (GHS-US): Danger
Hazard Statements (GHS-US):
May form combustible dust concentrations in air
H301 - Toxic if swallowed
H332 - Harmful if inhaled
H351 - Suspected of causing cancer
H401 - Toxic to aquatic life
H411 - Toxic to aquatic life with long lasting effects

Precautionary Statements (GHS-US):
P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P261 - Avoid breathing dust.
P264 - Wash hands, forearms, and other exposed areas thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P273 - Avoid release to the environment.
P280 - Wear protective gloves, protective clothing, eye protection, face protection,
respiratory protection.
P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P304+P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position
comfortable for breathing.
P308+P313 - If exposed or concerned: Get medical advice/attention.
Antimony
Safety Data Sheet
according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

P312 - Call a POISON CENTER/doctor/physician if you feel unwell.
P321 - Specific treatment (see section 4).
P330 - If swallowed, rinse mouth.
P391 - Collect spillage.
P405 - Store locked up.
P501 - Dispose of contents/container to local, regional, national, territorial, provincial, and international regulations.

2.3. Other Hazards

Other Hazards Not Contributing to the Classification: Exposure may aggravate those with pre-existing eye, skin, or respiratory conditions. May form combustible dust concentrations in air. Exposure may aggravate individuals with pre-existing skin, kidney, liver, and pulmonary disorders. On burning release of harmful/irritant gases/vapours (antimony oxides). Inhalation of dusts and fumes can cause metal fume fever. Symptoms can include a metallic or sweet taste in the mouth, sweating, shivering, headache, throat irritation, fever, chills, thirstiness, muscle aches, nausea, vomiting, weakness, fatigue, and shortness of breath.

2.4. Unknown Acute Toxicity (GHS-US)

No data available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substance

Name : Antimony

<table>
<thead>
<tr>
<th>Name</th>
<th>Product identifier</th>
<th>%</th>
<th>Classification (GHS-US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>(CAS No) 7440-36-0</td>
<td>100</td>
<td>Comb. Dust</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute Tox. 3 (Oral), H301</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute Tox. 4 (Inhalation), H332</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Carc. 2, H351</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aquatic Acute 2, H401</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aquatic Chronic 2, H411</td>
</tr>
</tbody>
</table>

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: FIRST AID MEASURES

4.1. Description of First Aid Measures

First-aid Measures General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid Measures After Inhalation: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.

First-aid Measures After Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation persists.

First-aid Measures After Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation persists.

First-aid Measures After Ingestion: Rinse mouth. Do not induce vomiting. Seek medical attention if a large amount is swallowed.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/Injuries: Suspected of causing cancer. Toxic if swallowed. Harmful if inhaled.

Symptoms/Injuries After Inhalation: Harmful if inhaled. Respiratory tract irritation.

Symptoms/Injuries After Skin Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Eye Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Ingestion: Toxic if swallowed. May cause nausea, vomiting, and diarrhea.

Chronic Symptoms: Prolonged exposure may cause effects in specific organs such as the liver, kidneys, blood, and nervous system.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention.

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing Media

Suitable Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire.
5.2. Special Hazards Arising From the Substance or Mixture

Fire Hazard: Not considered flammable but may burn at high temperatures. Dust explosion hazard in air.

Explosion Hazard: Avoid dust clouds in combination with static electricity. Dust explosion hazard in air.

Reactivity: Hazardous reactions will not occur under normal conditions. Dust clouds can be explosive.

5.3. Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire.

Firefighting Instructions: Use water spray or fog for cooling exposed containers. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection.

Other information: Risk of dust explosion. Do not allow the product to be released into the environment. Do not allow run-off from fire fighting to enter drains or water courses.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Use special care to avoid static electric charges. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Handle in accordance with good industrial hygiene and safety practice. Do not breathe dust. Avoid generating dust. Avoid all contact with skin, eyes, or clothing.

6.1.1. For Non-emergency Personnel

Protective Equipment: Use appropriate personal protection equipment (PPE).


6.1.2. For Emergency Responders

Protective Equipment: Equip cleanup crew with proper protection. Use appropriate personal protection equipment (PPE).

Emergency Procedures: Ventilate area.

6.2. Environmental Precautions

Prevent entry to sewers and public waters. Do not allow to enter drains or water courses.

6.3. Methods and Material for Containment and Cleaning Up

For Containment: Avoid generation of dust during clean-up of spills. Use only non-sparking tools.

Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Avoid generation of dust during clean-up of spills. Use only non-sparking tools. Use explosion proof vacuum during cleanup, with appropriate filter, do not mix with other materials. Contact competent authorities after a spill.

6.4. Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Additional Hazards When Processed: Avoid dust production. Accumulation and dispersion of dust with an ignition source can cause a combustible dust explosion, keep dust levels to a minimum and follow applicable regulations. Do not pressurize, cut, or weld containers. On burning: release of harmful/irritant gases/vapours e.g.: (antimony oxides).

Precautions for Safe Handling: Use only non-sparking tools. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Handle in accordance with good industrial hygiene and safety procedures.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work. Do no eat, drink or smoke when using this product.

7.2. Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Proper grounding procedures to avoid static electricity should be followed. Ground/bond container and receiving equipment. Use explosion-proof electrical, ventilating, and lighting equipment. Comply with applicable regulations.

Storage Conditions: Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep/Store away from extremely high or low temperatures, ignition sources, incompatible materials.


7.3. Specific End Use(s)

No additional information available

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters

<table>
<thead>
<tr>
<th>Substance</th>
<th>ACGIH TWA (mg/m³)</th>
<th>NIOSH REL (TWA) (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>0.5 mg/m³</td>
<td>0.5 mg/m³</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>USA IDLH (mg/m³)</th>
<th>OSHA PEL (TWA) (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mg/m³</td>
<td>0.5 mg/m³</td>
</tr>
</tbody>
</table>

8.2. Exposure Controls

Appropriate Engineering Controls: Ensure all national/local regulations are observed. Proper grounding procedures to avoid static electricity should be followed. Use explosion-proof equipment. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas.


Materials for Protective Clothing: Chemically resistant materials and fabrics.

Hand Protection: Wear chemically resistant protective gloves.

Eye Protection: Chemical goggles or safety glasses.

Skin and Body Protection: Wear suitable protective clothing.

Respiratory Protection: Use NIOSH-approved air-purifying or supplied-air respirator where airborne concentrations of dust are expected to exceed exposure limits.

Thermal Hazard Protection: Wear suitable protective clothing.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on Basic Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Odor</td>
<td>No data available</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Relative Evaporation Rate (butylacetate=1)</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No data available</td>
</tr>
<tr>
<td>Auto-ignition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>Relative Vapor Density at 20 °C</td>
<td>No data available</td>
</tr>
<tr>
<td>Relative Density</td>
<td>No data available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>No data available</td>
</tr>
<tr>
<td>Solubility</td>
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</tr>
<tr>
<td>Log Pow</td>
<td>No data available</td>
</tr>
<tr>
<td>Log Kow</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity, Kinematic</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity, Dynamic</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Oxidizing Properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive Limits</td>
<td>No data available</td>
</tr>
</tbody>
</table>
9.2. Other Information  No additional information available

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity: Hazardous reactions will not occur under normal conditions. Dust clouds can be explosive.
10.2 Chemical Stability: Dust clouds can be explosive.
10.3 Possibility of Hazardous Reactions: Hazardous polymerization will not occur.
10.4 Conditions to Avoid: Direct sunlight. Extremely high or low temperatures. Open flame. Ignition sources. Incompatible materials.
10.6 Hazardous Decomposition Products: Antimony and its oxides. Metal oxides. Inhalation of fumes may cause metal fume fever.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information On Toxicological Effects
Acute Toxicity: Toxic if swallowed. Harmful if inhaled.

<table>
<thead>
<tr>
<th>Antimony</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ATE (Oral)</td>
<td>500,000 mg/kg body weight</td>
</tr>
<tr>
<td>ATE (Dust/Mist)</td>
<td>1,500 mg/l/4h</td>
</tr>
<tr>
<td>Antimony (7440-36-0)</td>
<td></td>
</tr>
<tr>
<td>LD50 Oral Rat</td>
<td>100 mg/kg</td>
</tr>
<tr>
<td>ATE (Oral)</td>
<td>100,000 mg/kg body weight</td>
</tr>
</tbody>
</table>

Skin Corrosion/Irritation: Not classified
Serious Eye Damage/Irritation: Not classified
Respiratory or Skin Sensitization: Not classified
Germ Cell Mutagenicity: Not classified
Carcinogenicity: Suspected of causing cancer.
Reproductive Toxicity: Not classified
Specific Target Organ Toxicity (Single Exposure): Not classified
Specific Target Organ Toxicity (Repeated Exposure): Not classified
Aspiration Hazard: Not classified
Symptoms/Injuries After Inhalation: Harmful if inhaled. Respiratory tract irritation.
Symptoms/Injuries After Skin Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.
Symptoms/Injuries After Eye Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.
Symptoms/Injuries After Ingestion: Toxic if swallowed. May cause nausea, vomiting, and diarrhea.
Chronic Symptoms: Prolonged exposure may cause effects in specific organs such as the liver, kidneys, blood, and nervous system.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity
Ecology - General: Toxic to aquatic life with long lasting effects.

12.2. Persistence and Degradability
Antimony
Persistence and Degradability: May cause long-term adverse effects in the environment.

12.3. Bioaccumulative Potential  No additional information available
12.4. Mobility in Soil  No additional information available
12.5. Other Adverse Effects
Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods
Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, and international regulations.
Additional Information: The materials contained within this product are hazardous to the environment, do not release into the environment.
** SECTION 14: TRANSPORT INFORMATION **

14.1 In Accordance with DOT

- **Proper Shipping Name**: ANTIMONY POWDER
- **Hazard Class**: 6.1
- **Identification Number**: UN2871
- **Label Codes**: 6.1
- **Packing Group**: III
- **Marine Pollutant**: Marine pollutant
- **ERG Number**: 170

14.2 In Accordance with IMDG

- **Proper Shipping Name**: ANTIMONY POWDER
- **Hazard Class**: 6.1
- **Identification Number**: UN2871
- **Packing Group**: III
- **Label Codes**: 6.1

14.3 In Accordance with IATA

- **Proper Shipping Name**: ANTIMONY POWDER
- **Packing Group**: III
- **Identification Number**: UN2871
- **Hazard Class**: 6
- **Label Codes**: 6.1
- **ERG Code (IATA)**: 6L

** SECTION 15: REGULATORY INFORMATION **

15.1 US Federal Regulations

- **Antimony**
  - SARA Section 311/312 Hazard Classes
    - Delayed (chronic) health hazard
    - Immediate (acute) health hazard

- **Antimony (7440-36-0)**
  - Listed on the United States TSCA (Toxic Substances Control Act) inventory
  - Listed on SARA Section 313 (Specific toxic chemical listings)
  - SARA Section 313 - Emission Reporting
    - 1.0 %

15.2 US State Regulations

- **Antimony (7440-36-0)**
  - U.S. - California - Priority Toxic Pollutants - Human Health Criteria
  - U.S. - California - Toxic Air Contaminant List (AB 1807, AB 2728)
  - U.S. - Colorado - Primary Drinking Water Regulations - Maximum Contaminant Level Goals (MCLGs)
  - U.S. - Colorado - Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)
  - U.S. - Connecticut - Drinking Water Quality Standards - Maximum Contaminant Levels
  - U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
  - U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
  - U.S. - Connecticut - Water Quality Standards - Consumption of Organisms Only
  - U.S. - Connecticut - Water Quality Standards - Consumption of Water and Organisms
  - U.S. - Connecticut - Water Quality Standards - Health Designations
  - U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
  - U.S. - Florida - Drinking Water Standards - Inorganic Contaminants - Maximum Contaminant Levels (MCLs)
  - U.S. - Georgia - Drinking Water - Maximum Contaminant Levels (MCLs)
  - U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
  - U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)
  - U.S. - Idaho - Occupational Exposure Limits - TWAs

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| U.S. - Illinois - Toxic Air Contaminants |
| U.S. - Louisiana - Reportable Quantity List for Pollutants |
| U.S. - Maine - Air Pollutants - Hazardous Air Pollutants |
| U.S. - Maryland - Surface Water Quality Standards - Consumption of Organisms Only |
| U.S. - Maryland - Surface Water Quality Standards - Consumption of Water and Organisms |
| U.S. - Massachusetts - Allowable Ambient Limits (AALs) |
| U.S. - Massachusetts - Allowable Threshold Concentrations (ATCs) |
| U.S. - Massachusetts - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1 |
| U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2 |
| U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity |
| U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1 |
| U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2 |
| U.S. - Massachusetts - Right To Know List |
| U.S. - Massachusetts - Threshold Effects Exposure Limits (TELs) |
| U.S. - Massachusetts - Toxics Use Reduction Act |
| U.S. - Michigan - Occupational Exposure Limits - TWAs |
| U.S. - Michigan - Polluting Materials List |
| U.S. - Minnesota - Chemicals of High Concern |
| U.S. - Minnesota - Groundwater Health Risk Limits |
| U.S. - Minnesota - Hazardous Substance List |
| U.S. - Minnesota - Permissible Exposure Limits - TWAs |
| U.S. - Missouri - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - Nebraska - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - New Hampshire - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour |
| U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual |
| U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances |
| U.S. - New Jersey - Environmental Hazardous Substances List |
| U.S. - New Jersey - Primary Drinking Water Standards - Maximum Contaminant Levels - MCLs |
| U.S. - New Jersey - Right to Know Hazardous Substance List |
| U.S. - New Jersey - Water Quality - Ground Water Quality Criteria |
| U.S. - New Jersey - Water Quality - Practical Quantitation Levels (PQLs) |
| U.S. - New York - Occupational Exposure Limits - TWAs |
| U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances |
| U.S. - North Dakota - Air Pollutants - Guideline Concentrations - 8-Hour |
| U.S. - North Dakota - Water Quality Standards - Human Health Value for Class III |
| U.S. - North Dakota - Water Quality Standards - Human Health Value for Classes I, IA, II |
| U.S. - Oregon - Permissible Exposure Limits - TWAs |
| U.S. - Pennsylvania - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List |
| U.S. - Pennsylvania - RTK (Right to Know) List |
| U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 24-Hour |
| U.S. - Rhode Island - Water Quality Standards - Acute Freshwater Aquatic Life Criteria |
| U.S. - Rhode Island - Water Quality Standards - Chronic Freshwater Aquatic Life Criteria |
| U.S. - Rhode Island - Water Quality Standards - Human Health Criteria for Consumption of Aquatic Organisms Only |
| U.S. - Rhode Island - Water Quality Standards - Human Health Criteria for Consumption of Water and Aquatic Organisms |
| U.S. - South Carolina - Maximum Contaminant Levels (MCLs) |
| U.S. - Tennessee - Occupational Exposure Limits - TWAs |
| U.S. - Texas - Drinking Water Standards - Maximum Contaminant Levels (MCLs) |
| U.S. - Texas - Effects Screening Levels - Long Term |
| U.S. - Texas - Effects Screening Levels - Short Term |
| U.S. - Utah - Drinking Water - Maximum Contaminant Levels (MCLs) |
| U.S. - Vermont - Hazardous Waste - Hazardous Constituents |
| U.S. - Vermont - Permissible Exposure Limits - TWAs |
| U.S. - Virginia - Water Quality Standards - Public Water Supply Effluent Limits |
| U.S. - Virginia - Water Quality Standards - Surface Waters Not Used for the Public Water Supply Effluent Limits |

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SECTION 16: OTHER INFORMATION

Revision date : 02/12/2014

Other Information : This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.

GHS Full Text Phrases:

<table>
<thead>
<tr>
<th>GHS Full Text Phrase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Tox. 3 (Oral)</td>
<td>Acute toxicity (oral) Category 3</td>
</tr>
<tr>
<td>Acute Tox. 4 (Inhalation)</td>
<td>Acute toxicity (inhalation) Category 4</td>
</tr>
<tr>
<td>Acute Tox. 4 (Inhalation:dust,mist)</td>
<td>Acute toxicity (inhalation:dust,mist) Category 4</td>
</tr>
<tr>
<td>Aquatic Acute 2</td>
<td>Hazardous to the aquatic environment - Acute Hazard Category 2</td>
</tr>
<tr>
<td>Aquatic Chronic 2</td>
<td>Hazardous to the aquatic environment - Chronic Hazard Category 2</td>
</tr>
<tr>
<td>Carc. 2</td>
<td>Carcinogenicity Category 2</td>
</tr>
<tr>
<td>Comb. Dust</td>
<td>Combustible Dust</td>
</tr>
<tr>
<td></td>
<td>May form combustible dust concentrations in air</td>
</tr>
<tr>
<td>H301</td>
<td>Toxic if swallowed</td>
</tr>
<tr>
<td>H332</td>
<td>Harmful if inhaled</td>
</tr>
<tr>
<td>H351</td>
<td>Suspected of causing cancer</td>
</tr>
<tr>
<td>H401</td>
<td>Toxic to aquatic life</td>
</tr>
<tr>
<td>H411</td>
<td>Toxic to aquatic life with long lasting effects</td>
</tr>
</tbody>
</table>

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SDS US (GHS HazCom) - US
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: AROCLOR 1260
Product Number: CRM48736
Brand: Supelco

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 1B), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word: Danger
Hazard statement(s)
H350 May cause cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none
3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distillates (petroleum), hydrotreated middle</td>
<td>Carc. 1B; H350</td>
<td>&gt;= 90 - &lt;= 100 %</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>64742-46-7</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>265-148-2</td>
<td></td>
</tr>
<tr>
<td>Index-No.</td>
<td>649-221-00-X</td>
<td></td>
</tr>
<tr>
<td>Baseoil - unspecified</td>
<td>Carc. 1B; H350</td>
<td>&gt;= 30 - &lt; 50 %</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>64742-53-6</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>265-156-6</td>
<td></td>
</tr>
<tr>
<td>Index-No.</td>
<td>649-466-00-2</td>
<td></td>
</tr>
<tr>
<td>2,6-di-tert-Butyl-p-cresol</td>
<td>Aquatic Acute 1; Aquatic Chronic 1; H410</td>
<td>&gt;= 0.1 - &lt; 1 %</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>128-37-0</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>204-881-4</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Nature of decomposition products not known.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distillates (petroleum), hydrotreated middle</td>
<td>64742-46-7</td>
<td>TWA</td>
<td>500.000000 ppm 2,000.000000 mg/m3</td>
<td>USA, Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

Remarks: The value in mg/m3 is approximate.
<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TWA</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>Baseoil - unspecified</td>
<td>TWA</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not classifiable as a human carcinogen</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

### 8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties
   a) Appearance
      Form: liquid
   b) Odour
      No data available
   c) Odour Threshold
      No data available
   d) pH
      No data available
   e) Melting point/freezing point
      No data available
   f) Initial boiling point and boiling range
      No data available
   g) Flash point
      No data available
   h) Evaporation rate
      No data available
   i) Flammability (solid, gas)
      No data available
   j) Upper/lower flammability or explosive limits
      No data available
   k) Vapour pressure
      No data available
   l) Vapour density
      No data available
   m) Relative density
      No data available
   n) Water solubility
      No data available
   o) Partition coefficient: n-octanol/water
      No data available
   p) Auto-ignition temperature
      No data available
   q) Decomposition temperature
      No data available
   r) Viscosity
      No data available
   s) Explosive properties
      No data available
   t) Oxidizing properties
      No data available

9.2 Other safety information
   No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   No data available

10.4 Conditions to avoid
   No data available

10.5 Incompatible materials
   Strong oxidizing agents

10.6 Hazardous decomposition products
   Other decomposition products - No data available
   In the event of fire: see section 5
11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

**Acute toxicity**
No data available

Inhalation: No data available

Dermal: No data available

**Skin corrosion/irritation**
No data available

**Serious eye damage/eye irritation**
No data available

**Respiratory or skin sensitisation**
No data available

**Germ cell mutagenicity**
No data available

**Carcinogenicity**

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (2,6-di-tert-Butyl-p-cresol)

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Distillates (petroleum), hydrotreated middle)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

No data available

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nerves. - (Aroclor 1260)

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available
12.4 Mobility in soil  
No data available

12.5 Results of PBT and vPvB assessment  
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects  
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods  
**Product**  
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

**Contaminated packaging**  
Dispose of as unused product.

14. TRANSPORT INFORMATION

**DOT (US)**  
Not dangerous goods

**IMDG**  
Not dangerous goods

**IATA**  
Not dangerous goods

15. REGULATORY INFORMATION

**SARA 302 Components**  
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**  
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**  
Chronic Health Hazard

**Massachusetts Right To Know Components**

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>64742-46-7</td>
<td>1989-08-11</td>
</tr>
<tr>
<td>64742-53-6</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>64742-46-7</td>
<td>1989-08-11</td>
</tr>
<tr>
<td>64742-53-6</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
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</thead>
<tbody>
<tr>
<td>64742-46-7</td>
<td>1989-08-11</td>
</tr>
<tr>
<td>64742-53-6</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**

WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>11096-82-5</td>
<td>2008-08-01</td>
</tr>
<tr>
<td>11096-82-5</td>
<td>2008-08-01</td>
</tr>
</tbody>
</table>

DISTILLATES (PETROLEUM), HYDROTREATED MIDDLE 64742-46-7 2013-12-20

WARNING: This product contains a chemical known to the
16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute  Acute aquatic toxicity
Aquatic Chronic  Chronic aquatic toxicity
Carc.  Carcinogenicity
H350  May cause cancer.
H410  Very toxic to aquatic life with long lasting effects.

HMIS Rating
Health hazard:  0
Chronic Health Hazard:  *
Flammability:  0
Physical Hazard  0

NFPA Rating
Health hazard:  0
Fire Hazard:  0
Reactivity Hazard:  0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a
guide. The information in this document is based on the present state of our knowledge and is applicable to the
product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the
product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling
or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing
slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3  Revision Date: 06/25/2015  Print Date: 05/11/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Aroclor 1268 solution
Product Number : 502146
Brand : Supelco

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger
Hazard statement(s)
H225 : Highly flammable liquid and vapour.
H304 : May be fatal if swallowed and enters airways.
H315 : Causes skin irritation.
H336 : May cause drowsiness or dizziness.
H410 : Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P210 : Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 : Keep container tightly closed.
P240 : Ground/bond container and receiving equipment.
P241 : Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/ eye protection/ face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2,2,4-Trimethylpentane</strong></td>
<td>Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410</td>
<td>&gt;= 90 - &lt;= 100 %</td>
</tr>
<tr>
<td><strong>PCB- Aroclor 1268</strong></td>
<td>STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H373, H410</td>
<td>&gt;= 0.1 - &lt; 1 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**
Flush eyes with water as a precaution.
If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
### Component Control parameters Basis

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,2,4-Trimethylpentane</td>
<td>540-84-1</td>
<td>TWA</td>
<td>300.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks: Upper Respiratory Tract irritation

| PCB- Aroclor 1268 | 11100-14-4 | TWA | 0.001000 mg/m3 | USA. NIOSH Recommended Exposure Limits |

Potential Occupational Carcinogen

---

### 8.2 Exposure controls

**Appropriate engineering controls**

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Body Protection**

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

| a) Appearance | Form: liquid |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | -116 °C (-177 °F) |
| f) Initial boiling point and boiling range | 99 °C (210 °F) at 1,013 hPa (760 mmHg) |
| g) Flash point | -12 °C (10 °F) - closed cup |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | Upper explosion limit: 6 % (V) Lower explosion limit: 1.1 % (V) |
| k) Vapour pressure | 55 hPa (41 mmHg) |
9.2 Other safety information

Relative vapour density 3.9

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available
Carcinogenicity
This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Liver - Irregularities - Based on Human Evidence
Liver - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence (PCB- Aroclor 1268)

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.
13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

**Product**
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging**
Dispose of as unused product.

14. TRANSPORT INFORMATION

**DOT (US)**
UN number: 1262  Class: 3  Packing group: II
Proper shipping name: Octanes, solution
Reportable Quantity (RQ): 1000 lbs
Poison Inhalation Hazard: No

**IMDG**
UN number: 1262  Class: 3  Packing group: II
EMS-No: F-E, S-E
Proper shipping name: OCTANES, SOLUTION
Marine pollutant: yes

**IATA**
UN number: 1262  Class: 3  Packing group: II
Proper shipping name: Octanes, solution

15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**

<table>
<thead>
<tr>
<th>2,2,4-Trimethylpentane</th>
<th>540-84-1</th>
<th>CAS-No.</th>
<th>2007-03-01</th>
<th>Revision Date</th>
</tr>
</thead>
</table>

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>2,2,4-Trimethylpentane</th>
<th>540-84-1</th>
<th>CAS-No.</th>
<th>2007-03-01</th>
<th>Revision Date</th>
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</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>2,2,4-Trimethylpentane</th>
<th>540-84-1</th>
<th>CAS-No.</th>
<th>2007-03-01</th>
<th>Revision Date</th>
</tr>
</thead>
</table>

**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

**WARNING! This product contains a chemical known to the State of California to cause cancer.**

<table>
<thead>
<tr>
<th>PCB- Aroclor 1268</th>
<th>11100-14-4</th>
<th>CAS-No.</th>
<th>2008-08-01</th>
<th>Revision Date</th>
</tr>
</thead>
</table>

**WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.**

| PCB- Aroclor 1268 | 11100-14-4 | CAS-No. | 2008-08-01 | Revision Date |
16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute  Acute aquatic toxicity
Aquatic Chronic  Chronic aquatic toxicity
Asp. Tox.  Aspiration hazard
Flam. Liq.  Flammable liquids
H225  Highly flammable liquid and vapour.
H304  May be fatal if swallowed and enters airways.
H315  Causes skin irritation.
H336  May cause drowsiness or dizziness.
H373  May cause damage to organs through prolonged or repeated exposure.
H400  Very toxic to aquatic life.
H410  Very toxic to aquatic life with long lasting effects.
Skin Irrit.  Skin irritation
STOT RE  Specific target organ toxicity - repeated exposure
STOT SE  Specific target organ toxicity - single exposure

**HMIS Rating**
- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 3
- Physical Hazard: 0

**NFPA Rating**
- Health hazard: 2
- Fire Hazard: 3
- Reactivity Hazard: 0

**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a
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or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing
slip for additional terms and conditions of sale.

**Preparation Information**

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3  Revision Date: 02/27/2015  Print Date: 05/11/2016
Divison of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

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</table>

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Section 1 - Product and Company Identification

ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Product Identification: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE
Date of MSDS: 08/01/1997 Technical Review Date: 09/01/1999
FSC: 6810 NIIN: LIIN: 00N092040
Submitter: N NF
Status Code: A
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information
Manufacturer's Name: UNITED MINERAL & CHEMICAL CORP
Manufacturer's Address1: 1100 VALLEYBROOK AVE
Manufacturer's Address2: LYNDHURST, NJ 07071
Manufacturer's Country: US
General Information Telephone: 201-507-3300
Emergency Telephone: (800)424-9300
Emergency Telephone: (800)424-9300
Chemtrec Telephone: (800)424-9300
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 87730

Contractor Information

Contractor's Name: UNITED MINERAL & CHEMICAL CORP
Contractor's Address1: 1100 VALLEYBROOK AVE
Contractor's Address2: LYNDHURST, NJ 07071
Contractor's Telephone: 201-507-3300
Contractor's CAGE: 87730

Section 2 - Composition/Information on Ingredients
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Ingredient Name: ARSENIC; (ARSENIC METAL)
Ingredient CAS Number: 7440-38-2 Ingredient CAS Code: T
RTECS Number: CG0525000 RTECS Code: T
=WT: 100. =WT Code: M
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text:
% Environmental Weight:
Other REC Limits: N/P
OSHA PEL: N/P OSHA PEL Code:
OSHA STEL: N/P OSHA STEL Code:
ACGIH TLV: 0.01 MG/M3 ACGIH TLV Code: T
ACGIH STEL: NOT ESTABLISHED ACGIH STEL Code: T
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE
Health Hazards Acute & Chronic: ARSENIC METAL IS NOT AS READILY AVAIL IN THE BODY AS ARSENIC IN THE FORM OF DUST OR VAP OR WHEN PROCESSED INTO ARSENIC CMPDS (ARSENCIALS). INORGANIC ARSENICALS ARE MORE TOXIC THAN ORGANIC ARSENICALS. ACUTE EFTS: ARSENIC IS POISON BY SUBCUTANEOUS, INTRAMUSCULAR & INTRAPERITONEAL ROUTES. ACUTE ARSENIC POISONING FROM INGEST RSLTS IN MARKED IRRIT OF STOMACH & INTESTINES W/NAUS, VOMIT & DIARR. IN SEV C ASE EFTS STOOLS & VOMIT ARE BLOODY & PATIENT MAY GO INTO COLLAPSE & SHOCK W/WEAK, RAPID PULSE, COLD SWEATS, COMA & DEATH. INHAL MAY CAUSE ULCERATION OF NASAL SEPTUM, RESP IRRIT. SKIN/EYE CNTCT MAY CAUSE DERM, SKIN & EYE (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure: HLTH HAZS: IRRIT. CHRONIC EFTS: ARSENIC IS CONFIRMED HUMAN CARCIN PRODUCING LIVER TUMORS & AN EXPERIMENTAL TERATOGEN (MAY CAUSE DMG TO DEVELOPING FETUS). CHRONIC ARSENIC POISONING MAY INCL ANY/ALL OF FOLLOWING: DIGEST SYS DISTURBS, LOSS OF APPETITE, CRAMPS, NAUS, CONSTIP, DIARR; LIVER DMG WHICH MAY RSLT IN JAUN; DISTURBS OF BLOOD, KIDNEYS & NERVOUS SYS; SKIN ABNORMS INCL ITCHING, PIGMENTATION & POS S CANCEROUS CHGS. TARGET ORGS FOR INORGANIC CMPDS AS AS): LIVER, KIDNEYS, SKIN, LUNGS, LYMPHATIC SYS. TLV: 0.01 MG/M3 TWA ARSENIC, ELEMENTAL & INORGANIC CMPDS (EXCEPT ARSINE), AS AS. OSHA PEL: (SUPD AT)

Medical Conditions Aggravated by Exposure: KNOWN EFFECTS ON OTHER ILLNESSES: GASTROINTESTINAL. NERVOUS SYSTEM. SKIN. LIVER & KIDNEY PROBLEMS. AFTER EXPOSURE HAVE URINE TEST.

LD50 LC50 Mixture: LD50: (ORAL, RAT) 763 MG/M3

Route of Entry Indicators:
- Inhalation: YES
- Skin: YES
- Ingestion: YES

Carcinogenicity Indicators
- NTP: YES
- IARC: YES
- OSHA: YES


Section 4 - First Aid Measures

ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

First Aid:
- SKIN: FLUSH WITH SOAP AND WATER. AVOID RUBBING INTO SKIN. CONTACT MD IMMEDIATELY. EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES. CONTACT PHYSICIAN IMMEDIATELY. INHALATION: REMOVE TO FRESH AIR. PROVIDE OXYGEN IF NECESSARY. CONTACT PHYSICIAN IMMEDIATELY. INGESTION: TREATMENT WITH BAS(DIMERCAPTO) IS OF QUESTIONABLE EFFECTIVENESS IN TRIVALENT ARSENIC COMPOUNDS. INDUCE VOMITING AND DO GASTRIC LAVAGE. GET PERSONNEL TO HOSPITAL IMMEDIATELY. A PHYSICIAN CAN INITIATE AN EXCHANGE TRANSFUSION AND DIALYSIS. ALSO ABSORPTION AND REMOVAL WITH ANIMAL BONE COAL OR FE(OH)*2 SHOULD BE DONE.
Section 5 - Fire Fighting Measures
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Fire Fighting Procedures:
USE NIOSH APPRVD SCBA & FULL PROT EQUIP (FP N). RESTRICT PERS NOT WEARING PROT EQUIP FROM AREA. TRY TO SNUFF FIRE W/SAND, DRY MEDIA, FOAM OR CO*2. IF NO OTHER OPTIONS AVAILABLE, USE WATER & ALWAYS WEAR NIOSH APPRVD SCBA OR NIOSH TOXIC VAPOR RESP. POISONOUS GASES ARE PRODUCED IN FIRE, INCLUDING ARSENIC OXIDES.

Unusual Fire or Explosion Hazard:
ARSENIC, WHEN HEATED OR IN CONTACT W/ACID OR ACID FUMES, CAN PRODUCE HIGHLY TOXIC FUMES. ARSENIC REACTS VIGOROUSLY W/OXIDIZING MATLS. ARSENIC IS FLAMMABLE IN FORM OF DUST WHEN EXPOSED TO HEAT OR FLAME OR BY CHEMICAL RXN W/POWERFUL OXIDIZERS. SLIGHT EXPLOSION HAZ EXISTS IN FORM OF DUST WHEN EXPOSED TO (ECOLOGICAL INFO)

Extinguishing Media:
FOAM, CARBON DIOXIDE, DRY CHEMICAL.

Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: N/K

Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Spill Release Procedures:
RESTRICT PERSONS NOT WEARING PROTECTIVE EQUIPMENT FROM AREA UNTIL CLEANUP IS COMPLETE. WEARING NIOSH APPROVED RESPIRATOR, GLOVES, GOGGLES, LAB COAT, GATHER UP CHUNKS, RODS OR GRANULES WITH VACUUM OR U TENSILS RESERVED FOR POISONOUS SOLIDS. AVOID RAISING DUST. VENTILATE THE AREA AFTER CLEANUP IS COMPLETE.

Section 7 - Handling and Storage
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Respiratory Protection:
NIOSH APPROVED, AIR PURIFYING, TOXIC VAPOR RESPIRATOR TO PARTICULATE AND FUME AIR LEVEL. FOR INORGANIC ARSENIC APPLICATIONS, SEE 29 CFR 1910.1018 FOR PROPER RESPIRATOR SELECTION.

Ventilation:
LOC EXHST/MECH (GEN) SCRUBBER OR TRAP IF POSS TO MAINTAIN EXPOS TO LESS THAN PERMISSIBLE LIMITS FOR ELEMENTAL ARSENIC & ANY CMPDS BEING GENERATED.
Section 9 - Physical & Chemical Properties
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: =612.3, 1133.6°F Boiling Point Text: SUBLIMES
Melting/Freezing Point: =814.3, ######F Melting/Freezing Text: @ 36 ATM. FP:N/A
Decomposition Point: Decomposition Text: N/P
Vapor Pressure: 1 MMHG @ 372°C Vapor Density: N/A
Percent Volatile Organic Content:
Specific Gravity: 5.727
Volatile Organic Content Pounds per Gallon:
pH: NONE-0% IN H*2O
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/A
Solubility in Water: INSOLUBLE
Appearance and Odor: SILVER GRAY CRYSTALLINE CHUNKS, RODS OR GRANULES; NO ODOR AS (ECOLOGICAL INFO)
Percent Volatiles by Volume: N/A (BY WT)
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Stability Indicator: YES
Materials to Avoid:
INCOMPATIBLE W/BROMINE AZIDE, DIRUBIDIIUM ACETYLIDE, HALOGENS, PALLADIUM ZINC, PLATINUM, NCL*3, AGNO*3, CRO*3, NA*2O*2, HEXAFLUOROISOPROPYLDENEAMINO LITHIUM. CAN REACT W/ACIDS OR ACID FUMES & POWERFUL OXIDIZERS SUCH AS BROM
Stability Condition to Avoid:
AVOID OPEN CONTAINERS AND CONTACT WITH INCOMPATIBLE MATERIALS.
Hazardous Decomposition Products:
ARSENIC FUMES, ARSINE, OTHER ARSENIC COMPOUNDS.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Toxicological Information:
LD50: TDLO 605 ?G/KG. ORAL-MAN TDLO 7857 MG/KG/55Y SKIN. DERMAL IRRITATION-
RABBIT: UNKNOWN; SUBCUTANEOUS IMPLANT RABBIT LTLO 75 MG/KG. EYE IRRITATION-
RABBIT: UNKNOWN.

Section 12 - Ecological Information
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Ecological Information:
N/P. EXPLO HAZ: FLAME. IN EVENT OF A FIRE OR SPILL CONTACT THE STATE DEPARTMENT
OF THE ENVIRONMENT & YOUR REGIONAL OFFICE OF THE FEDERAL EPA. PHYSICAL DATA -
APPEAR/ODOR: METAL AS COMPOUND, ASH*3, HAS GARLIC ODOR. ODOR THRESHOLD: N/A.
MATLS TO AVOID: CHLORATES, IODATES, PEROXIDES, LITHIUM, NAACL*3, KMNO*3, RB*2C*2,
AGNO*4, NOCL, IF*5, CRO*3, CLF*3, CLO, BRF*3, BRF*5, BRN*3, RBC*3BCH, CSC*3BCH.

Section 13 - Disposal Considerations
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Waste Disposal Methods:
SOLID WASTES SHOULD BE VITRIFIED, PLACED IN LABELED CNTNR & BURIED IN EPA
SUPERVISED FACILITY. ETCHING SOLNS & CUTTING WASTES SHOULD BE PRECIPITATED,
CEMENTED/VITRIFIED & PLACED IN METAL/PLASTIC LABEL ED CNTNRS & BURIED IN EPA
SUPERVISED FACILITY. PASS GAS THRU POTASSIUM PERMANGANATE, PRECIPITATE & T
REAT AS ABOVE. WASTE MAY BE CONSIDERED (SUPDAT)

Section 14 - MSDS Transport Information
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Transport Information:
DOT REGULATED: YES. RQ: (NA - PIECES ARE LARGER THAN 100 MICROMETERS IN
DIAMETER). IF REGULATED, PROPER SHIPPING NAME: ARSENIC. HAZARD CLASS: (6.1).
IDENTIFICATION NO: (UN1558). PACKING GROUP: (III). LABEL REQUIRED: (POISON). INLAND
B/L: ARSENIC, 6.1, UN1558, PACKING GROUP II, POISON. EMERGENCY RESPONSE GUIDE NO:
(152).

Section 15 - Regulatory Information
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

SARA Title III Information:
SARA TITLE III, SECT 313: LISTED.
Federal Regulatory Information:
TSCA: WE CERTIFY THAT ALL COMPONENTS OF THIS PRODUCT ARE REGISTERED UNDER THE
REGULATIONS OF THE TOXIC SUBSTANCES CONTROL ACT. HMIS: HEALTH (4);
FLAMMABILITY (0); REACTIVITY (1).
State Regulatory Information:

Section 16 - Other Information
ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE
Other Information:
WASTE DISP METH: HAZARDOUS DEPENDING ON LEVEL OF TOXICITY CHARACTERISTIC OF ARSENIC. SEE 40 CFR 261.24 FOR DETERMINATION. RCRA HAZARDOUS WASTE: YES RCRA @ D004; IF TESTED POSITIVE AS CHARACT OF TOXICITY FOR ARSENIC. CERCLA: YES. RQ (1 LB RQ IS APPLICABLE ONLY IF DIAMETER OF PIECES OF SOLID METAL RELEASED IS LESS THAN 100 MICROMETERS OR 0.004 INCH. THIS PROD FORM IS LARGER THAN 100 MICROMETERS & HAS NO RQ IN ITS CURRENT FORM. IF AS HAZ WASTE CHARACT OF ARSENIC, THEN RQ=1LB. FOLLOW ALL LOCAL, STATE AND FEDERAL INFO & REGULATIONS.

HAZCOM Label Information
Product Identification: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE
CAGE: 87730
Assigned Individual: N
Company Name: UNITED MINERAL & CHEMICAL CORP
Company PO Box:
Company Street Address1: 1100 VALLEYBROOK AVE
Company Street Address2: LYNDHURST, NJ 07071 US
Health Emergency Telephone: (800)424-9300
Label Required Indicator: Y
Date Label Reviewed: 09/01/1999
Status Code: A
Manufacturer's Label Number:
Date of Label:
Year Procured: N/K
Organization Code: F
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Severe
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: Slight

8/9/2002 10:40:46 AM
Material Safety Data Sheet

Barium Metal

MSDS # 84.00

Section 1: Product and Company Identification

**Barium Metal**

**Synonyms/General Names:** Barium

**Product Use:** For educational use only

**Manufacturer:** Columbus Chemical Industries, Inc., Columbus, WI 53925.

**24 Hour Emergency Information Telephone Numbers**

CHEMTREC (USA): 800-424-9300

CANUTEC (Canada): 613-424-6666

SchoolAR Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

---

Section 2: Hazards Identification

*Soft, silvery, lustrous metal immersed in heavy mineral oil; no odor.*

**WARNING!** Flammable solid, dangerous when wet, highly toxic by ingestion.

Flammable solid, keep away from all ignition sources. Contact with water produces flammable gas.

Target organs: Central nervous system, kidneys.

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

---

Section 3: Composition / Information on Ingredients

Barium Metal (7440-39-3), 100%

---

Section 4: First Aid Measures

Always seek professional medical attention after first aid measures are provided.

**Eyes:** Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.

**Skin:** Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.

**Ingestion:** Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 tbsp of activated charcoal mixed with 8 oz water.

**Inhalation:** Remove to fresh air. If not breathing, give artificial respiration.

---

Section 5: Fire Fighting Measures

Flammable solid. When heated to decomposition, emits acrid fumes and explosive hydrogen gas.

**Protective equipment and precautions for firefighters:** Do Not Use carbon dioxide, foam, water or halogenated extinguishing agents. Use class D extinguisher or smother with dry sand, dry clay, dry ground limestone or dry graphite. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA).

Material is not sensitive to mechanical impact or static discharge.

---

Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Sweep up spill and place material in a dry container for disposal. See Section 13 for disposal information.

---

Section 7: Handling and Storage

**Handling:** Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.

**Storage:** Store in Flammable Area [Red Storage] with other flammable materials and away from any strong oxidizers. Store in a dedicated flammables cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials.

---

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge.

Exposure guidelines: Barium compounds: OSHA PEL: 0.5 mg/m³ and ACGIH TLV: 0.5 mg/m³, STEL: N/A.

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9/22/2012
Section 9: Physical and Chemical Properties

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<th>Value</th>
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<tr>
<td>Molecular formula</td>
<td>Ba.</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>137.33</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>3.62 g/mL @ 20°C.</td>
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<tr>
<td>Vapor Density (air=1)</td>
<td>N/A.</td>
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<tr>
<td>Melting Point</td>
<td>850°C.</td>
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<tr>
<td>Boiling Point/Range</td>
<td>1695°C.</td>
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<tr>
<td>Vapor Pressure (20°C)</td>
<td>N/A.</td>
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<tr>
<td>Flash Point</td>
<td>N/A.</td>
</tr>
<tr>
<td>Autoignition Temp.</td>
<td>N/A.</td>
</tr>
<tr>
<td>Appearance</td>
<td>Silver metal in heavy mineral oil.</td>
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<tr>
<td>Odor</td>
<td>No odor.</td>
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<tr>
<td>Odor Threshold</td>
<td>N/A.</td>
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<tr>
<td>Solubility</td>
<td>Reacts violently with water.</td>
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<tr>
<td>Evaporation rate</td>
<td>N/A (Butyl acetate = 1).</td>
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<tr>
<td>Partition Coefficient</td>
<td>N/A (log PoW).</td>
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<tr>
<td>pH</td>
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<tr>
<td>LEL</td>
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N/A = Not available or applicable

Section 10: Stability and Reactivity

Avoid heat and ignition sources

Stability: Stable under normal conditions of use.

Incompatibility: Water, acids, chlorine, iodine, bromine and oxidizing agents.

Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information


Chronic Effects: Repeated/prolonged skin contact may cause dryness or rashes.

Sensitization: none expected

Barium: LD50 [oral, rat]: Not Available; LC50 [rat]: Not Available; LD50 Dermal [rabbit]: Not Available. Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial): LC50 – 500mg/l – 96h – Cyprinodon variegates.

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

Section 14: Transport Information

<table>
<thead>
<tr>
<th>DOT Shipping Name</th>
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<td>4.3, pg II.</td>
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<tr>
<td>UN Number</td>
<td>UN1400.</td>
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</tbody>
</table>

Section 15: Regulatory Information

EINECS: Listed (231-149.1).

TSCA: All components are listed or are exempt.


California Proposition 65: Not listed.

The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16: Other Information

Current Issue Date: September 22, 2012

Disclaimer: Scholar Chemistry and Columbus Chemical Industries, Inc., (“S&C”) believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because S&C has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. S&C makes no warranty, expressed or implied, including (without limitation) warranties with respect to the completeness or continuing accuracy of the information contained herein or with respect to fitness for any particular use.
SAFETY DATA SHEET

Benzene

Section 1. Identification

GHS product identifier : Benzene
Chemical name : benzene
Other means of identification : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol
Product use : Synthetic/Analytical chemistry.
Synonym : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol
SDS # : 001062
Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
GERM CELL MUTAGENICITY - Category 1B
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (bone marrow) - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger
Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Causes damage to organs through prolonged or repeated exposure. (bone marrow)

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.
Section 2. Hazards identification

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.

Response: Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF SWALLOWED: Call a POISON CENTER or physician if you feel unwell. Rinse mouth. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage: Store locked up. Store in a well-ventilated place. Keep cool.

Disposal: Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified: None known.

Section 3. Composition/information on ingredients

Substance/mixture: Substance
Chemical name: benzene
Other means of identification: benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

CAS number/other identifiers
- CAS number: 71-43-2
- Product code: 001062

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>%</th>
<th>CAS number</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>100</td>
<td>71-43-2</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Section 4. First aid measures

**Skin contact**: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

**Ingestion**: Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

**Notes to physician**: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

**Specific treatments**: No specific treatment.

**Protection of first-aiders**: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

**Potential acute health effects**

- **Eye contact**: Causes serious eye irritation.
- **Inhalation**: No known significant effects or critical hazards.
- **Skin contact**: Causes skin irritation.
- **Frostbite**: Try to warm up the frozen tissues and seek medical attention.
- **Ingestion**: Harmful if swallowed. Irritating to mouth, throat and stomach.

**Over-exposure signs/symptoms**

- **Eye contact**: Adverse symptoms may include the following:
  - pain or irritation
  - watering
  - redness

- **Inhalation**: No specific data.

- **Skin contact**: Adverse symptoms may include the following:
  - irritation
  - redness

- **Ingestion**: No specific data.

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to physician**: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

**Specific treatments**: No specific treatment.

**Protection of first-aiders**: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)
Section 5. Fire-fighting measures

Extinguishing media

| Suitable extinguishing media | Use dry chemical, CO₂, water spray (fog) or foam. |
| Unsuitable extinguishing media | Do not use water jet. |

Specific hazards arising from the chemical

Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous thermal decomposition products

Decomposition products may include the following materials:
- Carbon dioxide
- Carbon monoxide

Special protective actions for fire-fighters

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Environmental precautions

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill

Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill

Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Date of issue/Date of revision: 4/26/2015. Date of previous issue: 10/16/2014. Version: 0.03
Section 7. Handling and storage

Precautions for safe handling

Protective measures: Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities: Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>ACGIH TLV (United States, 3/2012). Absorbed through skin. STEL: 8 mg/m³ 15 minutes. STEL: 2.5 ppm 15 minutes. TWA: 1.6 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours. NIOSH REL (United States, 1/2013). STEL: 1 ppm 15 minutes. TWA: 0.1 ppm 10 hours. OSHA PEL (United States, 6/2010). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. OSHA PEL Z2 (United States, 11/2006). AMP: 50 ppm 10 minutes. CEIL: 25 ppm TWA: 10 ppm 8 hours.</td>
</tr>
</tbody>
</table>

Date of issue/Date of revision: 4/26/2015. Date of previous issue: 10/16/2014. Version: 0.03
Section 8. Exposure controls/personal protection

Appropriate engineering controls: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state: Liquid. [Watery liquid.]
Color: Colorless. Yellowish.
Molecular weight: 78.12 g/mole
Molecular formula: C6-H6
Boiling/condensation point: 80.09°C (176.2°F)
Melting/freezing point: 5.49°C (41.9°F)
Critical temperature: 288.95°C (552.1°F)
Odor: Characteristic.
Odor threshold: Not available.
Section 9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Not available.</td>
</tr>
<tr>
<td>Flash point</td>
<td>Closed cup: -11°C (12.2°F)</td>
</tr>
<tr>
<td>Burning time</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Burning rate</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>3.5 (butyl acetate = 1)</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not available.</td>
</tr>
<tr>
<td>Lower and upper explosive</td>
<td>Lower: 1.2%</td>
</tr>
<tr>
<td>(flammable) limits</td>
<td>Upper: 7.8%</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>10 kPa (75.006094245 mm Hg) [room temperature]</td>
</tr>
<tr>
<td>Vapor density</td>
<td>2.7 (Air = 1)</td>
</tr>
<tr>
<td>Specific Volume (ft³/lb)</td>
<td>1.1403</td>
</tr>
<tr>
<td>Gas Density (lb/ft³)</td>
<td>0.877 (20°C / 68 to °F)</td>
</tr>
<tr>
<td>Relative density</td>
<td>0.88</td>
</tr>
<tr>
<td>Solubility</td>
<td>Not available.</td>
</tr>
<tr>
<td>Solubility in water</td>
<td>1.88 g/l</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>2.13</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>498°C (928.4°F)</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>Not available.</td>
</tr>
<tr>
<td>SADT</td>
<td>Not available.</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Dynamic (room temperature): 0.604 mPa·s (0.604 cP)</td>
</tr>
</tbody>
</table>

Section 10. Stability and reactivity

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactivity</td>
<td>No specific test data related to reactivity available for this product or its ingredients.</td>
</tr>
<tr>
<td>Chemical stability</td>
<td>The product is stable.</td>
</tr>
<tr>
<td>Possibility of hazardous</td>
<td>Under normal conditions of storage and use, hazardous reactions will not occur.</td>
</tr>
<tr>
<td>reactions</td>
<td></td>
</tr>
<tr>
<td>Conditions to avoid</td>
<td>Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.</td>
</tr>
<tr>
<td>Incompatibility with various</td>
<td>Highly reactive or incompatible with the following materials: oxidizing materials.</td>
</tr>
<tr>
<td>substances</td>
<td></td>
</tr>
<tr>
<td>Hazardous decomposition</td>
<td>Under normal conditions of storage and use, hazardous decomposition products should not be produced.</td>
</tr>
<tr>
<td>products</td>
<td></td>
</tr>
<tr>
<td>Hazardous polymerization</td>
<td>Under normal conditions of storage and use, hazardous polymerization will not occur.</td>
</tr>
</tbody>
</table>
Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Result</th>
<th>Species</th>
<th>Dose</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>LC50 Inhalation Gas.</td>
<td>Rat</td>
<td>10000 ppm</td>
<td>7 hours</td>
</tr>
<tr>
<td>benzene</td>
<td>LD50 Oral</td>
<td>Rat</td>
<td>930 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

Irritation/Corrosion

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Result</th>
<th>Species</th>
<th>Score</th>
<th>Exposure</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>Eyes - Moderate irritant</td>
<td>Rabbit</td>
<td>-</td>
<td>88 milligrams</td>
<td>-</td>
</tr>
<tr>
<td>benzene</td>
<td>Eyes - Severe irritant</td>
<td>Rabbit</td>
<td>-</td>
<td>24 hours 2 milligrams</td>
<td>-</td>
</tr>
<tr>
<td>benzene</td>
<td>Skin - Mild irritant</td>
<td>Rat</td>
<td>-</td>
<td>8 hours 60 microliters</td>
<td>-</td>
</tr>
<tr>
<td>benzene</td>
<td>Skin - Mild irritant</td>
<td>Rabbit</td>
<td>-</td>
<td>24 hours 15 milligrams</td>
<td>-</td>
</tr>
<tr>
<td>benzene</td>
<td>Skin - Moderate irritant</td>
<td>Rabbit</td>
<td>-</td>
<td>24 hours 20 milligrams</td>
<td>-</td>
</tr>
</tbody>
</table>

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>OSHA</th>
<th>IARC</th>
<th>NTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>+</td>
<td>1</td>
<td>Known to be a human carcinogen.</td>
</tr>
</tbody>
</table>

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Route of exposure</th>
<th>Target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>Category 1</td>
<td>Not determined</td>
<td>bone marrow</td>
</tr>
</tbody>
</table>

Aspiration hazard

Not available.

Information on the likely routes of exposure

Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.
Inhalation : No known significant effects or critical hazards.
Benzene

**Section 11. Toxicological information**

- **Skin contact**: Causes skin irritation.
- **Ingestion**: Harmful if swallowed. Irritating to mouth, throat and stomach.

**Symptoms related to the physical, chemical and toxicological characteristics**

- **Eye contact**: Adverse symptoms may include the following:
  - pain or irritation
  - watering
  - redness
- **Inhalation**: No specific data.
- **Skin contact**: Adverse symptoms may include the following:
  - irritation
  - redness
- **Ingestion**: No specific data.

**Delayed and immediate effects and also chronic effects from short and long term exposure**

- **Short term exposure**
  - **Potential immediate effects**: Not available.
  - **Potential delayed effects**: Not available.
- **Long term exposure**
  - **Potential immediate effects**: Not available.
  - **Potential delayed effects**: Not available.

**Potential chronic health effects**

- **General**: Causes damage to organs through prolonged or repeated exposure.
- **Carcinogenicity**: May cause cancer. Risk of cancer depends on duration and level of exposure.
- **Mutagenicity**: May cause genetic defects.
- **Teratogenicity**: No known significant effects or critical hazards.
- **Developmental effects**: No known significant effects or critical hazards.
- **Fertility effects**: No known significant effects or critical hazards.

**Numerical measures of toxicity**

- **Acute toxicity estimates**: Not available.

**Section 12. Ecological information**

- **Toxicity**: Not available.
- **Persistence and degradability**: Not available.
- **Bioaccumulative potential**: Not available.

**Date of issue/Date of revision**: 4/26/2015.  **Date of previous issue**: 10/16/2014.  **Version**: 0.03
Benzene

Section 12. Ecological information

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>LogP&lt;sub&gt;ow&lt;/sub&gt;</th>
<th>BCF</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>2.13</td>
<td>11</td>
<td>low</td>
</tr>
</tbody>
</table>

**Mobility in soil**

Soil/water partition coefficient (K<sub>oc</sub>): Not available.

Other adverse effects: No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS #</th>
<th>Status</th>
<th>Reference number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene (I,T)</td>
<td>71-43-2</td>
<td>Listed</td>
<td>U019</td>
</tr>
</tbody>
</table>

Section 14. Transport information

<table>
<thead>
<tr>
<th>UN number</th>
<th>DOT</th>
<th>TDG</th>
<th>Mexico</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1114</td>
<td>UN1114</td>
<td>UN1114</td>
<td>UN1114</td>
<td>UN1114</td>
<td>UN1114</td>
</tr>
<tr>
<td>UN proper shipping name</td>
<td>BENZENE</td>
<td>BENZENE</td>
<td>BENZENE</td>
<td>BENZENE</td>
<td>BENZENE</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Packing group</td>
<td>II</td>
<td>II</td>
<td>II</td>
<td>II</td>
<td>II</td>
</tr>
<tr>
<td>Additional information</td>
<td>Reportable quantity 10 lbs / 4.54 kg [1.3675 gal / 5.1767 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.</td>
<td>Explosive Limit and Limited Quantity Index 1 Passenger Carrying Road or Rail Index 5</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td></td>
<td>Passenger and Cargo Aircraft Quantity limitation: 5 L Cargo Aircraft Only Quantity limitation: 60 L Limited Quantities - Passenger Aircraft Quantity limitation: 1 L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date of issue/Date of revision: 4/26/2015. Date of previous issue: 10/16/2014. Version: 0.03 10/14
Section 14. Transport information

| Limited quantity | Yes. |
| Package instruction | Passenger aircraft |
| Quantity limitation | 5 L |
| Cargo aircraft |
| Quantity limitation | 60 L |
| Special provisions | IB2, T4, TP1 |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Special precautions for user : Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.
Clean Water Act (CWA) 307: benzene
Clean Water Act (CWA) 311: benzene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed
Clean Air Act Section 602 Class I Substances : Not listed
Clean Air Act Section 602 Class II Substances : Not listed
DEA List I Chemicals (Precursor Chemicals) : Not listed
DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304
Composition/information on ingredients
No products were found.

SARA 304 RQ
SARA 311/312
Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients
### Section 15. Regulatory information

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>100</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
</tbody>
</table>

#### SARA 313

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form R - Reporting requirements benzene</td>
<td>71-43-2</td>
<td>100</td>
</tr>
<tr>
<td>Supplier notification benzene</td>
<td>71-43-2</td>
<td>100</td>
</tr>
</tbody>
</table>

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

#### State regulations

- **Massachusetts**: This material is listed.
- **New York**: This material is listed.
- **New Jersey**: This material is listed.
- **Pennsylvania**: This material is listed.

#### California Prop. 65

**WARNING**: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Cancer</th>
<th>Reproductive</th>
<th>No significant risk level</th>
<th>Maximum acceptable dosage level</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzene</td>
<td>Yes.</td>
<td>Yes.</td>
<td>6.4 µg/day (ingestion)</td>
<td>24 µg/day (ingestion)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13 µg/day (inhalation)</td>
<td>49 µg/day (inhalation)</td>
</tr>
</tbody>
</table>

#### Canada inventory

: This material is listed or exempted.

#### International regulations

#### International lists

- **Australia inventory (AICS)**: This material is listed or exempted.
- **China inventory (IECSC)**: This material is listed or exempted.
- **Japan inventory**: This material is listed or exempted.
- **Korea inventory**: This material is listed or exempted.
- **Malaysia Inventory (EHS Register)**: Not determined.
- **New Zealand Inventory of Chemicals (NZIoC)**: This material is listed or exempted.
- **Philippines inventory (PICCS)**: This material is listed or exempted.
- **Taiwan inventory (CSNN)**: Not determined.

#### Chemical Weapons Convention List Schedule I Chemicals

: Not listed

#### Chemical Weapons Convention List Schedule II Chemicals

: Not listed

#### Chemical Weapons Convention List Schedule III Chemicals

: Not listed

---

**Date of issue/Date of revision**: 4/26/2015.  
**Date of previous issue**: 10/16/2014.  
**Version**: 0.03  
12/14

Powered by IHS
Section 15. Regulatory information

**WHMIS (Canada)**
- Class B-2: Flammable liquid
- Class D-2A: Material causing other toxic effects (Very toxic).
- Class D-2B: Material causing other toxic effects (Toxic).

**CEPA Toxic substances**: This material is listed.
**Canadian ARET**: This material is not listed.
**Canadian NPRI**: This material is listed.

**Alberta Designated Substances**: This material is not listed.
**Ontario Designated Substances**: This material is not listed.
**Quebec Designated Substances**: This material is not listed.

Section 16. Other information

**Canada Label requirements**
- Class B-2: Flammable liquid
- Class D-2A: Material causing other toxic effects (Very toxic).
- Class D-2B: Material causing other toxic effects (Toxic).

**Hazardous Material Information System (U.S.A.)**

- **Flammability**: 2
- **Health**: 3
- **Physical hazards**: 0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

**National Fire Protection Association (U.S.A.)**

- **Flammability**: 3
- **Health**: 2
- **Instability/Reactivity**: 0

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

**History**
- **Date of printing**: 4/26/2015.
- **Date of issue/Date of revision**: 4/26/2015.
- **Date of previous issue**: 10/16/2014.
- **Version**: 0.03
Section 16. Other information

Key to abbreviations:
- ATE = Acute Toxicity Estimate
- BCF = Bioconcentration Factor
- GHS = Globally Harmonized System of Classification and Labelling of Chemicals
- IATA = International Air Transport Association
- IBC = Intermediate Bulk Container
- IMDG = International Maritime Dangerous Goods
- LogPow = logarithm of the octanol/water partition coefficient
- UN = United Nations
- ACGIH – American Conference of Governmental Industrial Hygienists
- AIHA – American Industrial Hygiene Association
- CAS – Chemical Abstract Services
- CEPA – Canadian Environmental Protection Act
- CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
- CPR – Controlled Products Regulations
- DSL – Domestic Substances List
- GWP – Global Warming Potential
- IARC – International Agency for Research on Cancer
- ICAO – International Civil Aviation Organisation
- Inh – Inhalation
- LC – Lethal concentration
- LD – Lethal dosage
- NDSL – Non-Domestic Substances List
- NIOSH – National Institute for Occupational Safety and Health
- TDG – Canadian Transportation of Dangerous Goods Act and Regulations
- TLV – Threshold Limit Value
- TSCA – Toxic Substances Control Act
- WEEL – Workplace Environmental Exposure Level
- WHMIS – Canadian Workplace Hazardous Material Information System

References:
- Not available.

Notice to reader:
To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Date of issue/Date of revision: 4/26/2015. Date of previous issue: 10/16/2014. Version: 0.03
1. Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

- **Synonyms:** benz[e]acephenanthrylene
- **CAS No.:** 205-99-2
- **EC index No.:** 601-034-00-4
- **EINECS No.:** 205-911-9
- **RTECS No.:** CU1400000
- **Molecular weight:** 252.32
- **Formula:** C_{20}H_{12}

1.2 Use of the substance or the preparation:

Certified reference material for laboratory use only

1.3 Company/undertaking identification:

Institute for Reference Materials and Measurements
Retieseweg
B-2440 Geel
Tel. : +32 14 57 12 11
Fax : +32 14 58 42 73

1.4 Telephone number for emergency:

+32 70 245 245
Antigifcentrum
p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

2. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Hazardous ingredients</th>
<th>CAS No.</th>
<th>Conc. in %</th>
<th>Hazard symbol</th>
<th>Risks (R-phrases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzo[b]fluoranthene</td>
<td>205-99-2</td>
<td>100</td>
<td>T;N</td>
<td>45-50/53 (1)</td>
</tr>
<tr>
<td></td>
<td>205-911-9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) For R-phrases in full: see heading 16

3. Hazards identification

- May cause cancer
- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:
- Consult a doctor/medical service if irritation persists
- Rinse immediately with water
- Do not apply neutralizing agents

4.2 Skin contact:
- Consult a doctor/medical service if irritation persists
- Wash with water and soap
- Remove clothing before washing
- Do not apply (chemical) neutralizing agents

4.3 After inhalation:
- Consult a doctor/medical service if breathing problems develop
- Remove the victim into fresh air
- Unconscious: maintain adequate airway and respiration

4.4 After ingestion:
- Consult a doctor/medical service if you feel unwell
BENZO[b]FLUORANTHENE

- Immediately give lots of water to drink
- Never give water to an unconscious person
- Do not induce vomiting
5. Fire-fighting measures

5.1 Suitable extinguishing media:
- Water spray
- Polymer foam
- ABC powder
- Carbon dioxide

5.2 Unsuitable extinguishing media:
- Solid water jet ineffective as extinguishing medium

5.3 Special exposure hazards:
- Not easily combustible
- Upon combustion CO and CO2 are formed

5.4 Instructions:
- Take account of toxic firefighting water
- Use firefighting water moderately and contain it

5.5 Special protective equipment for firefighters:
- Heat/fire exposure: compressed air/oxygen apparatus
- Dust cloud production: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal protection/precautions: see 8.1/8.3/10.3

6.2 Environmental precautions:
- Prevent soil and water pollution
- Substance must not be discharged into the sewer
- Dam up the solid spill

6.3 Methods for cleaning up:
- Stop dust cloud by covering with sand/earth
- Carefully collect the spill/leftovers
- Scoop solid spill into closing containers
- Take collected spill to manufacturer/competent authority
- Clean contaminated surfaces with an excess of water
- Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:
- Observe strict hygiene
- Avoid prolonged and repeated contact with skin
- Avoid raising dust
- Do not discharge the waste into the drain
- Clean contaminated clothing

7.2 Storage:
- Keep container tightly closed.
- Store in a cool area
- Store in a dry area
- Store in a dark area
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

  Storage temperature : N.D. °C
  Quantity limits : N.D. kg
  Storage life : N.D.

7.3 Specific uses: N.D.
8. Exposure controls/Personal protection

8.1 Exposure limit values:

<table>
<thead>
<tr>
<th>Limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLV-TWA</td>
<td>not listed</td>
</tr>
<tr>
<td>TLV-STEML</td>
<td>not listed</td>
</tr>
<tr>
<td>TLV-Ceiling</td>
<td>not listed</td>
</tr>
<tr>
<td>OES-LTEL</td>
<td>not listed</td>
</tr>
<tr>
<td>OES-STEML</td>
<td>not listed</td>
</tr>
<tr>
<td>MEL-LTEL</td>
<td>not listed</td>
</tr>
<tr>
<td>MEL-STEML</td>
<td>not listed</td>
</tr>
<tr>
<td>MAK</td>
<td>not listed</td>
</tr>
<tr>
<td>TRK</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-TGG 8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-TGG 15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-Ceiling</td>
<td>not listed</td>
</tr>
<tr>
<td>VME-8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>VLE-15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>GWBB-8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>GWK-15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>Momentary value</td>
<td>not listed</td>
</tr>
</tbody>
</table>

Sampling methods:
- Benzo(b)fluoranthene (Polynuclear aromatic hydrocarbons) NIOSH 5515
- Benzo(b)fluoranthene (Polynuclear aromatic hydrocarbons) NIOSH 5506

8.2 Exposure controls:

8.2.1 Occupational exposure controls:
- Measure the concentration in the air regularly
- Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see 13

8.3 Personal protection:

8.3.1 respiratory protection:
- Dust production: dust mask with filter type P3
- High dust production: compressed air/oxygen apparatus

8.3.2 hand protection:
- Gloves
  Suitable materials: No data available
- Breakthrough time: N.D.

8.3.3 eye protection:
- Safety glasses
- In case of dust production: protective goggles

8.3.4 skin protection:
- Protective clothing
- In case of dust production: head/neck protection
  Suitable materials: No data available
9. Physical and chemical properties

9.1 General information:

- Appearance (at 20°C): Crystalline solid / Needles
- Odour: Odourless
- Colour: Colourless to off-white

9.2 Important health, safety and environmental information:

- pH value: N.D.
- Boiling point/boiling range: N.D. °C
- Flashpoint: N.D. °C
- Explosion limits: N.D. vol% (°C)
- Vapour pressure (at 20°C): 0.00000067 hPa
- Vapour pressure (at 50°C): N.D. hPa
- Relative density (at 20°C): N.D.
- Water solubility: 0.00000012 g/100 ml
- Soluble in: Acetone, oils/fats
- Relative vapour density: N.D.
- Viscosity: N.D. Pa.s
- Partition coefficient n-octanol/water: 6.57
- Evaporation rate:
  - ratio butyl acetate: N.D.
  - ratio ether: N.D.

9.3 Other information:

- Melting point/melting range: 168 °C
- Auto-ignition point: N.D. °C
- Saturation concentration: N.D. g/m^3

10. Stability and reactivity

10.1 Conditions to avoid/reactivity:
- Stable under normal conditions

10.2 Materials to avoid:
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

10.3 Hazardous decomposition products:
- Upon combustion CO and CO2 are formed
- Reacts violently with (strong) oxidizers
- Decomposes on exposure to (strong) acids
11. Toxicological information

11.1 Acute toxicity:

<table>
<thead>
<tr>
<th></th>
<th>LD50 oral rat</th>
<th>LD50 dermal rat</th>
<th>LD50 dermal rabbit</th>
<th>LC50 inhalation rat</th>
<th>LC50 inhalation rabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N.D. mg/kg</td>
<td>N.D. mg/kg</td>
<td>N.D. mg/kg</td>
<td>N.D. mg/l/4 h</td>
<td>N.D. ppm/4 h</td>
</tr>
</tbody>
</table>

11.2 Chronic toxicity:

benzo[b]fluoranthene

<table>
<thead>
<tr>
<th></th>
<th>EC carc. cat.</th>
<th>EC muta. cat.</th>
<th>EC repr. cat.</th>
<th>Carcinogenicity (TLV)</th>
<th>Carcinogenicity (MAC)</th>
<th>Carcinogenicity (VME)</th>
<th>Carcinogenicity (GWBB)</th>
<th>Carcinogenicity (MAK)</th>
<th>Mutagenicity (MAK)</th>
<th>Teratogenicity (MAK)</th>
<th>IARC classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>not listed</td>
<td>not listed</td>
<td>A2</td>
<td>K</td>
<td>not listed</td>
<td>not listed</td>
<td>2</td>
<td>not listed</td>
<td>-</td>
<td>2B</td>
</tr>
</tbody>
</table>

11.3 Routes of exposure: ingestion, inhalation, eyes and skin

Caution! Substance is absorbed through the skin

11.4 Acute effects/symptoms:

- AFTER SKIN CONTACT
  Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic
- Not classified as toxic to reproduction (EC)

- ON CONTINUOUS/REPEATED EXPOSURE/CONTACT:
  No specific information available

- SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:
  Feeling of weakness
  Cracking of the skin
  Skin rash/inflammation
  Photoallergy
  Skin cancer
  Lung tissue affection/degeneration
  Enlargement/affection of the liver
  Affection of the renal tissue
12. Ecological information

12.1 Ecotoxicity:
- - No data available

12.2 Mobility:
- Volatile organic compounds (VOC): 0%
- Photolysis in water
- Forming sediments in water
- Insoluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:
- biodegradation $\text{BOD}_5$: N.D. $\% \text{ ThOD}$
- water: Not readily biodegradable in water
  - test: $E 1/2 > 100$ d.
- soil: $T \%$: > 87 days

12.4 Bioaccumulative potential:
- $\log P_{ow}$: 6.57
- BCF: 168 h: 2800 (LAMELLIBRANCHIATA)

- Highly bioaccumulative

12.5 Other adverse effects:
- WGK: 3 (Classification based on the R-phrases in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)
- Effect on the ozone layer: Not dangerous for the ozone layer (Council Regulation (EC) No 3093/94, O.J. L333 of 22/12/94)
- Greenhouse effect: no data available
- Effect on waste water purification: no data available

13. Disposal considerations

13.1 Provisions relating to waste:
- Waste material code (91/689/EEC, Council Decision 201/118/EC, O.J. L47 of 16/2/2001): 16 05 06 (laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory)
- Waste material code (Flanders): 001, 045, 691
- Waste code (Germany): 59302
- Hazardous waste (91/689/EEC)

13.2 Disposal methods:
- Dissolve or mix with a combustible solvent
- Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber

13.3 Packaging/Container:
14. Transport information

14.1 Classification of the substance in compliance with UN Recommendations

UN number: 3077
CLASS: 9
SUB RISKS: -
PACKING: III
PROPER SHIPPING NAME: UN 3077, Environmentally hazardous substance, solid, n.o.s. (benz[e]acephenanthrylene)

14.2 ADR (transport by road)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.3 RID (transport by rail)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.4 ADNR (transport by inland waterways)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.5 IMDG (maritime transport)

CLASS: 9
SUB RISKS: -
PACKING: III
MFAG: -
EMS: -
MARINE POLLUTANT: P

14.6 ICAO (air transport)

CLASS: 9
SUB RISKS: -
PACKING: III
PACKING INSTRUCTIONS PASSENGER AIRCRAFT: 
PACKING INSTRUCTIONS CARGO AIRCRAFT: 

14.7 Special precautions in connection with transport

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:
each package shall display a diamond-shaped figure with the following inscription:
- 'UN 3077'
or, in the case of different goods with different identification numbers within a single package:
- the letters 'LQ'
15. Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S53 : Avoid exposure - obtain special instructions before use
S45 : In case of accident or if you feel unwell, seek medical advice (show the label where possible)
S60 : This material and/or its container must be disposed of as hazardous waste
S61 : Avoid release to the environment. Refer to special instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. = NOT APPLICABLE
N.D. = NOT DETERMINED
* = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Exposure limits:

TLV : Threshold Limit Value - ACGIH USA 2000
OES : Occupational Exposure Standards - United Kingdom 1999
MEL : Maximum Exposure Limits - United Kingdom 1999
MAK : Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK : Technische Richtkonzentrationen - Germany 2001
MAC : Maximale aanvaarde concentratie - The Netherlands 2002
VME : Valeurs limites de Moyenne d’Exposition - France 1999
VLE : Valeurs limites d’Exposition à court terme - France 1999
GWBB : Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK : Grenswaarde kortstondige blootstelling - Belgium 1998
EC : Indicative occupational exposure limit values - directive 2000/39/EC

Chronic toxicity:

K : List of the carcinogenic substances and processes - The Netherlands 2002
BCR-048R: benzo[k]fluoranthene

1. Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:
   - Product name: BCR-048R: benzo[k]fluoranthene
   - CAS number: 207-08-9
   - EC index number: 601-036-00-5
   - EINECS number: 205-916-6
   - RTECS number: DF6350000
   - Molecular mass: 252.32 g/mol
   - Formula: C20H12

1.2 Use of the substance/preparation:
   Certified reference material for laboratory use only

1.3 Company/undertaking identification:
   Institute for Reference Materials and Measurements
   Retieseweg
   B-2440 Geel
   Tel: +32 14 57 12 11
   Fax: +32 14 59 04 06
   JRC-IRMM-RM-Sales@ec.europa.eu

1.4 Emergency telephone:
   Poison Centre: +32 70 245 245

2. Hazards identification

   NFPA: 1-1-2(*)

   DSD/DPD
   May cause cancer
   Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

   Other hazards
   Its dust is explosive with air
   Dust cloud can be ignited by a spark
   Slightly irritant to skin
   Slightly irritant to eyes
   Caution! Substance is absorbed through the skin
   No certainty about human mutagenic properties
   Highly bioaccumulative
   Not readily biodegradable in water

   CLP
   Carc. 1B May cause cancer. (H350)
   Aquatic Acute 1 Very toxic to aquatic life. (H400)
   Aquatic Chronic 1 Very toxic to aquatic life with long lasting effects. (H410)

   Other hazards
   Its dust is explosive with air
   Dust cloud can be ignited by a spark
   Slightly irritant to skin
   Slightly irritant to eyes
   Caution! Substance is absorbed through the skin
   No certainty about human mutagenic properties
   Highly bioaccumulative
   Not readily biodegradable in water
3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS No/EINECS/ELINCS</th>
<th>Conc.</th>
<th>Classification according to DSD/DPD</th>
<th>Classification according to CLP</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>benzo[k]fluoranthene</td>
<td>207-08-9 205-916-6</td>
<td>Carc. 1B; R45 N; R50-53</td>
<td>Carc. Cat. 2; H45 N; R50-53</td>
<td>Aquatic Acute 1; H400 Aquatic Chronic 1; H410</td>
<td></td>
</tr>
</tbody>
</table>

4. First aid measures

4.1 After inhalation:
- Remove the victim into fresh air
- Respiratory problems: consult a doctor/medical service

4.2 Skin contact:
- Rinse with water
- Do not apply (chemical) neutralizing agents
- Take victim to a doctor if irritation persists

4.3 Eye contact:
- Rinse with water
- Do not apply neutralizing agents
- Take victim to an ophthalmologist if irritation persists

4.4 After ingestion:
- Rinse mouth with water
- Immediately after ingestion: give lots of water to drink
- Do not induce vomiting
- Consult a doctor/medical service if you feel unwell

5. Fire-fighting measures

5.1 Suitable extinguishing media:
- Water spray
- Polyvalent foam
- ABC powder
- Carbon dioxide

5.2 Unsuitable extinguishing media:
- No unsuitable extinguishing media known

5.3 Special exposure hazards:
- Heating increases the fire hazard
- Dust cloud can be ignited by a spark
- Upon combustion CO and CO2 are formed

5.4 Instructions:
- Take account of toxic fire-fighting water
- Use water moderately and if possible collect or contain it

5.5 Special protective equipment for fire-fighters:
- Gloves
- Protective clothing
- Heat/fire exposure: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal precautions:
- See heading 8.2

6.2 Environmental precautions:
- Dam up the solid spill
- Prevent soil and water pollution
- Prevent spreading in sewers
6.3 Methods for cleaning up:
- Scoop solid spill into closing containers
- Carefully collect the spill/leftovers
- Clean contaminated surfaces with an excess of water
- Take collected spill to manufacturer/competent authority
- Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:
- Avoid raising dust
- Warning! Avoid exposure
- Keep away from naked flames/heat
- Obtain special instructions before use
- Observe strict hygiene
- Keep container tightly closed
- Do not discharge the waste into the drain

7.2 Storage:
- Safe storage requirements:
  - Store in a cool area
  - Store in a dry area
  - Keep container in a well-ventilated place
  - Keep locked up
  - Unauthorized persons are not admitted
  - Meet the legal requirements
- Keep away from:
  - oxidizing agents
  - (strong) acids

7.3 Specific use(s):
- See information supplied by the manufacturer for the identified use(s)

8. Exposure controls/Personal protection

8.1 Exposure limit values:
- 8.1.1 Occupational exposure:
  - If limit values are applicable and available these will be listed below.
- 8.1.2 Sampling methods:

<table>
<thead>
<tr>
<th>Product name</th>
<th>Test</th>
<th>Number</th>
<th>Sampling method</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benz(a)Anthracene</td>
<td>OSHA</td>
<td>CSI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benz(a)Anthracene (Polynuclear aromatic hydrocarbons)</td>
<td>NIOSH</td>
<td>5506</td>
<td>adsorption tubes</td>
<td></td>
</tr>
<tr>
<td>Benz(a)Anthracene (Polynuclear aromatic hydrocarbons)</td>
<td>NIOSH</td>
<td>5515</td>
<td>adsorption tubes</td>
<td></td>
</tr>
</tbody>
</table>

8.2 Exposure controls:
- 8.2.1 Occupational exposure controls:
  - Measure the concentration in the air regularly
  - Carry operations in the open/under local exhaust/ventilation or with respiratory protection
  - Personal protective equipment:
    - a) Respiratory protection:
      - Dust production: dust mask with filter type P3
    - b) Hand protection:
      - Gloves
    - c) Eye protection:
      - Safety glasses
      - In case of dust production: protective goggles
    - d) Skin protection:
      - Protective clothing
- 8.2.2 Environmental exposure controls:
9. Physical and chemical properties

9.1 General information:
- **Physical form**: Crystalline solid
- **Needles**
- **Colour**: Light yellow

9.2 Important health, safety and environmental information:
- **Boiling point**: 480 °C
- **Vapour pressure (20°C)**: < 0.00001 hPa
- **Solubility in water**: < 0.00001 g/100 ml
- **Solubility in solvents**:
  - Soluble in ethanol
  - Soluble in acetic acid
  - Soluble in oils/fats
- **Log Pow**: 6.84

9.3 Other information:
- **Melting point**: 217 °C

10. Stability and reactivity

10.1 Conditions to avoid:
- **Possible fire hazard**
  - heat sources
  - ignition sources

- **Stability**: No data available

- **Reactions**: Reacts violently with (strong) oxidizers

10.2 Materials to avoid:
- oxidizing agents
- (strong) acids

10.3 Hazardous decomposition products:
- Upon combustion CO and CO2 are formed

11. Toxicological information

11.1 Acute toxicity:
- No (test)data available.

11.2 Chronic toxicity:
- Probably human carcinogenic
- No certainty about human mutagenic properties
- Not classified as toxic to reproduction (EC)

<table>
<thead>
<tr>
<th>BCR-048R: benzo[k]fluoranthene</th>
<th>EC carc cat</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed in SZW - List of carcinogenic substances</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>IARC - classification</td>
<td>2B</td>
<td></td>
</tr>
<tr>
<td>MAK - Krebserzeugend Kategorie</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MAK - Keimzellmutagen Kategorie</td>
<td>3B</td>
<td></td>
</tr>
<tr>
<td>MAK - Schwangerschaft Gruppe</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CLP carc cat</td>
<td>category 1B</td>
<td></td>
</tr>
</tbody>
</table>

11.3 Acute effects/symptoms:

- **Inhalation**:
  - No data available

- **Skin contact**:
  - No data available
Slight irritation

Eye contact:
Slight irritation

Ingestion:
No data available

11.4 Chronic effects:
ON CONTINUOUS/REPEATED EXPOSURE/CONTACT:
No specific information available
SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:
Feeling of weakness
Cracking of the skin
Skin rash/inflammation
Photoallergy
Skin cancer
Lung tissue affection/degeneration
Enlargement/affection of the liver
Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:
No (test)data available.

12.2 Mobility:
Volatile organic compounds (VOC) 0 %
Solubility in reaction with water Insoluble in water
Water physicochemical processes Forming sediments in water
Soil physicochemical processes Adsorbs into the soil

12.3 Persistence and degradability:
Water abiotic degradation processes Ozonation in water
Half-life soil 65 - 1400 days
Not readily biodegradable in water

12.4 Bioaccumulative potential:
Log Pow 6.84
Highly bioaccumulative

12.5 Results of PBT assessment:
Not applicable, based on available data

12.6 Other adverse effects:
Not dangerous for the ozone layer (Council Regulation (EC) no 1005/2009)

13. Disposal considerations

13.1 Provisions relating to waste:
Waste material code (Directive 2008/98/EC, decision 2001/118/EC)
16 05 06*: laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals
Depending on branch of industry and production process, also other EURAL codes may be applicable
Hazardous waste according to Directive 2008/98/EC

13.2 Disposal methods:
Dissolve or mix with a combustible solvent
Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber with energy recovery
Remove waste in accordance with local and/or national regulations
Do not discharge into surface water (2000/60/EC, Council decision 2455/2001/EC, O.J. L331 of 15/12/2001)

13.3 Packaging/Container:
Waste material code packaging (Directive 2008/98/EC)
15 01 10*: packaging containing residues of or contaminated by dangerous substances

13.4 Entsorgung verschmutzter Gebinde:
### 14. Transport information

<table>
<thead>
<tr>
<th>ADR</th>
<th>Proper shipping name</th>
<th>Environmentally hazardous substance, solid, n.o.s.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Techn./chem. name ADR</td>
<td>benzo[k]fluoranthene</td>
</tr>
<tr>
<td></td>
<td>UN number</td>
<td>3077</td>
</tr>
<tr>
<td></td>
<td>Class</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Packing group</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Hazard identification number</td>
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</tr>
<tr>
<td></td>
<td>Classification code</td>
<td>M7</td>
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<tr>
<td></td>
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</tr>
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<td></td>
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</tr>
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</table>

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<th>Environmentally hazardous substance, solid, n.o.s.</th>
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<td>Techn./chem. name RID</td>
<td>benzo[k]fluoranthene</td>
</tr>
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<td>3077</td>
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<tr>
<td></td>
<td>Class</td>
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</tr>
<tr>
<td></td>
<td>Packing group</td>
<td>III</td>
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<tr>
<td></td>
<td>Classification code</td>
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<tr>
<td></td>
<td>Labels</td>
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<table>
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</thead>
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<td>benzo[k]fluoranthene</td>
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<td></td>
<td>Class</td>
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<tr>
<td></td>
<td>Packing group</td>
<td>III</td>
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<td>Classification code</td>
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<td></td>
<td>Labels</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Environmentally hazardous substance mark</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMO</th>
<th>Proper shipping name</th>
<th>Environmentally hazardous substance, solid, n.o.s.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Techn./chem. name IMO</td>
<td>benzo[k]fluoranthene</td>
</tr>
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<td></td>
<td>UN number</td>
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</tr>
<tr>
<td></td>
<td>Class</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Packing group</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Marine pollutant</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Environmentally hazardous substance mark</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ICAO</th>
<th>Proper shipping name</th>
<th>Environmentally hazardous substance, solid, n.o.s.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Techn./chem. name ICAO</td>
<td>benzo[k]fluoranthene</td>
</tr>
<tr>
<td></td>
<td>UN number</td>
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<tr>
<td></td>
<td>Class</td>
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<td>Packing group</td>
<td>III</td>
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<tr>
<td></td>
<td>Labels</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Environmentally hazardous substance mark</td>
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</tr>
</tbody>
</table>

### 15. Regulatory information

#### 15.1 EU Legislation:

Revision number: 0200
Product number: 49287
Reference number: BCR-048R
BCR-048R: benzo[k]fluoranthene

DSD/DPD
Enumerated in substance list Annex I of directive 67/548/EEC et sequens

R-phrases
45  May cause cancer
50/53  Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S-phrases
53  Avoid exposure - obtain special instructions before use
45  In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
60  This material and its container must be disposed of as hazardous waste
81  Avoid release to the environment. Refer to special instructions/safety data sheets.

Additional recommendations
Restricted to professional users.

CLP
Classification and labelling according to Regulation (EC) No 1272/2008 – Annex VI and after evaluation of available test data

Signal word
Dgr  Danger

H-statements
H350  May cause cancer.
H410  Very toxic to aquatic life with long lasting effects.

P-statements
P202  Do not handle until all safety precautions have been read and understood.
P281  Use personal protective equipment as required.
P273  Avoid release to the environment.
P308 + P313  If exposed or concerned: Get medical advice/attention.
P391  Collect spillage.
P405  Store locked up.

Supplemental information
Restricted to professional users.

15.2 National provisions:

15.3 Specific community rules:

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Reference legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG/552/2009</td>
<td>See column 1: 50. g</td>
</tr>
</tbody>
</table>

16. Other information
The information in this safety data sheet is based on data and samples provided to BIG. The sheet was written to the best of our ability and according to the state of knowledge at that time. The safety data sheet only constitutes a guideline for the safe handling, use, consumption, storage, transport and disposal of the substances/preparations/mixtures mentioned under point 1. New safety data sheets are written from time to time. Only the most recent versions may be used. Old versions must be destroyed. Unless indicated otherwise word for word on the safety data sheet, the information does not apply to substances/preparations/mixtures in purer form, mixed with other substances or in processes. The safety data sheet offers no quality specification for the substances/preparations/mixtures in question.

Compliance with the instructions in this safety data sheet does not release the user from the obligation to take all measures dictated by common sense, regulations and recommendations or which are necessary and/or useful based on the real applicable circumstances. BIG does not guarantee the accuracy or exhaustiveness of the information provided. Use of this safety data sheet is subject to the licence and liability limiting conditions as stated in your BIG licence agreement. All intellectual property rights to this sheet are the property of BIG and its distribution and reproduction are limited. Consult your BIG licence agreement for details.

(*) = INTERNAL CLASSIFICATION (NFPA)
PBT-substances = persistent, bioaccumulative and toxic substances
DSD Dangerous Substance Directive
DPD Dangerous Preparation Directive
CLP (EU-GHS) Classification, labelling and packaging (Globally Harmonised System in Europe)

Full text of any R-phrases referred to under headings 2 and 3:

<table>
<thead>
<tr>
<th>R-Phrase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R45</td>
<td>May cause cancer</td>
</tr>
<tr>
<td>R50/53</td>
<td>Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment</td>
</tr>
</tbody>
</table>

Full text of any H-statements referred to under headings 2 and 3:

<table>
<thead>
<tr>
<th>H-Phrase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H350</td>
<td>May cause cancer.</td>
</tr>
<tr>
<td>H400</td>
<td>Very toxic to aquatic life.</td>
</tr>
<tr>
<td>H410</td>
<td>Very toxic to aquatic life with long lasting effects.</td>
</tr>
</tbody>
</table>

Full text of any classes referred to under headings 2 and 3:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute</td>
<td>Hazardous to the aquatic environment - acute</td>
</tr>
<tr>
<td>Aquatic Chronic</td>
<td>Hazardous to the aquatic environment - chronic</td>
</tr>
<tr>
<td>Carc.</td>
<td>Carcinogenicity</td>
</tr>
</tbody>
</table>
SAFETY DATA SHEET

Based on Directive 2001/58/EC et seq. of the Commission of the European Communities

BENZ[a]ANTHRACENE

1. Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms: benzo(a)anthracene

CAS No. : 56-55-3
EC index No. : 601-033-00-9
RTECS No. : CV9275000

1.2 Use of the substance or the preparation:

Certified reference material for laboratory use only

1.3 Company/undertaking identification:

Institute for Reference Materials and Measurements
Retieseweg
B-2440 Geel
Tel. : +32 14 57 12 11
Fax : +32 14 58 42 73

1.4 Telephone number for emergency:

+32 70 245 245
Antigifcentrum
p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

2. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Hazardous ingredients</th>
<th>CAS No. EINECS No.</th>
<th>Conc. in %</th>
<th>Hazard symbol</th>
<th>Risks (R-phrases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo[a]anthracene</td>
<td>56-55-3 200-280-6</td>
<td>100</td>
<td>T;N</td>
<td>45-50/53 (1)</td>
</tr>
</tbody>
</table>

(1) For R-phrases in full: see heading 16

3. Hazards identification

- May cause cancer
- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:
- Consult a doctor/medical service if irritation persists
- Rinse immediately with water

4.2 Skin contact:
- Consult a doctor/medical service if irritation persists
- Wash with water and soap
- Remove clothing before washing

4.3 After inhalation:
- Consult a doctor/medical service if breathing problems develop
- Remove the victim into fresh air
- Unconscious: maintain adequate airway and respiration

4.4 After ingestion:
- Consult a doctor/medical service if you feel unwell
- Immediately give lots of water to drink
- Never give water to an unconscious person
BENZ[a]ANTHRACENE
5. Fire-fighting measures

5.1 Suitable extinguishing media:
- Water spray
- Alcohol foam
- Polymer foam
- ABC powder
- Carbon dioxide

5.2 Unsuitable extinguishing media:
- Solid water jet ineffective as extinguishing medium

5.3 Special exposure hazards:
- Not easily combustible
- Upon combustion CO and CO2 are formed

5.4 Instructions:
- Take account of toxic firefighting water
- Use firefighting water moderately and contain it

5.5 Special protective equipment for firefighters:
- Heat/fire exposure: compressed air/oxygen apparatus
- Dust cloud production: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal protection/precautions: see heading 8.1/8.3/10.3

6.2 Environmental precautions:
- Prevent soil and water pollution
- Substance must not be discharged into the sewer
- Dam up the solid spill

6.3 Methods for cleaning up:
- Stop dust cloud by covering with sand/earth
- Carefully collect the spill/leftovers
- Scoop solid spill into closing containers
- Take collected spill to manufacturer/competent authority
- Clean contaminated surfaces with an excess of water
- Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:
- Observe strict hygiene
- Avoid prolonged and repeated contact with skin
- Avoid raising dust
- Do not discharge the waste into the drain
- Remove contaminated clothing immediately

7.2 Storage:
- Keep container tightly closed. Store in a cool area. Store in a dry area.
- Store in a dark area.
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

<table>
<thead>
<tr>
<th>Storage temperature</th>
<th>N.D. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity limits</td>
<td>N.D. kg</td>
</tr>
<tr>
<td>Storage life</td>
<td>N.D.</td>
</tr>
<tr>
<td>Materials for packaging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>suitable : no data available</td>
</tr>
<tr>
<td></td>
<td>to avoid : no data available</td>
</tr>
</tbody>
</table>

7.3 Specific uses:
- See information supplied by the manufacturer
8. Exposure controls/Personal protection

8.1 Exposure limit values:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLV-TWA</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>TLV-STEL</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>TLV-Ceiling</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>OES-LTEL</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>OES-STEL</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>MAK</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>TRK</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>MAC-TGG 8 h</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>MAC-TGG 15 min.</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>MAC-Ceiling</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>VME-8 h</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>VLE-15 min.</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>GWB-8 h</td>
<td>mg/m³</td>
<td>ppm</td>
</tr>
<tr>
<td>GWK-15 min.</td>
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<td>ppm</td>
</tr>
<tr>
<td>Momentary value</td>
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<td>ppm</td>
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<tr>
<td>EC</td>
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<td>ppm</td>
</tr>
<tr>
<td>EC-STEL</td>
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<td>ppm</td>
</tr>
</tbody>
</table>

Sampling methods:
- Benz(a)Anthracene (Polynuclear aromatic hydrocarbons) NIOSH 5506
- Benz(a)Anthracene (Polynuclear aromatic hydrocarbons) NIOSH 5515
- Benz(a)Anthracene OSHA CSI

8.2 Exposure controls:

8.2.1 Occupational exposure controls:
- Measure the concentration in the air regularly
- Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see heading 13

8.3 Personal protection:

8.3.1 Respiratory protection:
- Dust production: dust mask with filter type P3
- High dust production: compressed air/oxygen apparatus

8.3.2 Hand protection:
- Gloves
  Suitable materials: No data available
  Breakthrough time: N.D.

8.3.3 Eye protection:
- Safety glasses
- In case of dust production: protective goggles

8.3.4 Skin protection:
- Protective clothing
- In case of dust production: head/neck protection
  Suitable materials: No data available
9. **Physical and chemical properties**

9.1 **General information:**

- Appearance (at 20°C): Crystalline solid / Scales
- Odour: Odourless
- Colour: Colourless to fluorescent yellow-green

9.2 **Important health, safety and environmental information:**

- pH value: N.D.
- Boiling point/boiling range: N.A. °C
- Flashpoint: N.D. °C
- Explosion limits: N.D. vol% (°C)
- Vapour pressure (at 20°C): 0.00007 hPa
- Flashpoint: N.D. °C
- Relative density (at 20°C): 1.3
- Water solubility: 0.00001 g/100 ml
- Vapour pressure (at 50°C): N.D. hPa
- Relative density: N.D.
- Water solubility: Ether, acetone, oils/fats
- Relative vapour density: N.D.
- Viscosity: N.D. Pa.s
- Partition coefficient n-octanol/water: 5.61/5.79
- Evaporation rate ratio to butyl acetate: N.D.
- Evaporation rate ratio to ether: N.D.

9.3 **Other information:**

- Melting point/melting range: 160 °C
- Auto-ignition point: N.D. °C
- Saturation concentration: N.D. g/m³

10. **Stability and reactivity**

10.1 **Conditions to avoid/reactivity:**
- Stable under normal conditions

10.2 **Materials to avoid:**
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

10.3 **Hazardous decomposition products:**
- Upon combustion CO and CO₂ are formed
- Reacts violently with (strong) oxidizers
- Decomposes on exposure to (strong) acids

11. **Toxicological information**

11.1 **Acute toxicity:**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD₅₀ oral rat</td>
<td>N.D.</td>
<td>mg/kg</td>
</tr>
<tr>
<td>LD₅₀ dermal rat</td>
<td>N.D.</td>
<td>mg/kg</td>
</tr>
<tr>
<td>LD₅₀ dermal rabbit</td>
<td>N.D.</td>
<td>mg/kg</td>
</tr>
<tr>
<td>LC₅₀ inhalation rat</td>
<td>N.D.</td>
<td>mg/l/4 h</td>
</tr>
<tr>
<td>LC₅₀ inhalation rat</td>
<td>N.D.</td>
<td>ppm/4 h</td>
</tr>
</tbody>
</table>
11.2 Chronic toxicity:

EC carc. cat. : 2
EC muta. cat. : not listed
EC repr. cat. : not listed

Carcinogenicity (TLV) : A2
Carcinogenicity (MAC) : K
Carcinogenicity (VME) : not listed
Carcinogenicity (GWBB) : not listed

Carcinogenicity (MAK) : 2
Mutagenicity (MAK) : not listed
Teratogenicity (MAK) : -

IARC classification : 2A

11.3 Routes of exposure:  ingestion, inhalation, eyes and skin
Caution! Substance is absorbed through the skin

11.4 Acute effects/symptoms:

AFTER SKIN CONTACT
- Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic
- Mutagenicity: AMES test positive
- Probably human mutagenic

ON CONTINUOUS/REPEATED EXPOSURE/CONTACT:
- No specific information available

SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:
- Feeling of weakness
- Photoallergy
- Skin rash/inflammation
- Cracking of the skin
- Skin cancer
- Lung tissue affection/degeneration
- Enlargement/affection of the liver
- Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:

- LC50 (65 h) : 0.0018 mg/l (PIMEPHALES PROMELAS)
- EC50 (96 h) : 0.01 mg/l (DAPHNIA PULEX)

12.2 Mobility:

- Volatile organic compounds (VOC): 0%
- Photolysis in water
- Ozonation in water
- Insoluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- biodegradation BOD₅ : N.D. % ThOD
- water : - Not readily biodegradable in water
- soil : T ½: > 100 days

12.4 Bioaccumulative potential:

- log Pₕₙ : 5.61/5.79
- BCF : 72 h : 350 (LEUCISCUS IDUS)
- Highly bioaccumulative
12.5 Other adverse effects:

- **WGK**: 3 (Classification based on the R-phrases in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)
- **Effect on the ozone layer**: Not dangerous for the ozone layer (Council Regulation (EC) 3093/94)
- **Greenhouse effect**: no data available
- **Effect on waste water purification**: no data available

13. Disposal considerations

13.1 Provisions relating to waste:

- Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 16 05 06 (laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals)
- Waste material code (Flanders): 001, 045, 691
- Waste code (Germany): 59302
- Hazardous waste (91/689/EEC)

13.2 Disposal methods:

- Dissolve or mix with a combustible solvent
- Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber

13.3 Packaging/Container:

14. Transport information

14.1 Classification of the substance in compliance with UN Recommendations

UN number: 3077
CLASS: 9
SUB RISKS: -
Packing: III
PROPER SHIPPING NAME: UN 3077, Environmentally hazardous substance, solid, n.o.s. (benzo[a]anthracene)

14.2 ADR (transport by road)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.3 RID (transport by rail)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.4 ADNR (transport by inland waterways)

CLASS: 9
PACKING: III
DANGER LABEL TANKS: 9
DANGER LABEL PACKAGES: 9

14.5 IMDG (maritime transport)

CLASS: 9
SUB RISKS: -
Packing: III
MFAG: -
EMS: -
MARINE POLLUTANT: P

14.6 ICAO (air transport)

CLASS: 9
SUB RISKS: -
Packing: III
PACKING INSTRUCTIONS PASSENGER AIRCRAFT: -
PACKING INSTRUCTIONS CARGO AIRCRAFT: -

14.7 Special precautions in connection with transport: none

14.8 Limited quantities (LQ):

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:

- each package shall display a diamond-shaped figure with the following inscription: "UN 3077"
- in the case of different goods with different identification numbers within a single package:
- the letters 'LQ'
15. Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S53 : Avoid exposure - obtain special instructions before use
S45 : In case of accident or if you feel unwell, seek medical advice (show the label where possible)
S60 : This material and/or its container must be disposed of as hazardous waste
S61 : Avoid release to the environment. Refer to special instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. = NOT APPLICABLE
N.D. = NOT DETERMINED
* = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Exposure limits:

TLV : Threshold Limit Value - ACGIH USA 2000
OES : Occupational Exposure Standards - United Kingdom 1999
MEL : Maximum Exposure Limits - United Kingdom 1999
MAK : Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK : Technische Richtkonzentrationen - Germany 2001
MAC : Maximale aanvaarde concentratie - The Netherlands 2002
VME : Valeurs limites de Moyenne d’Exposition - France 1999
VLE : Valeurs limites d’Exposition à court terme - France 1999
GWBB : Grenswaarde beroepmatige blootstelling - Belgium 1998
GWK : Grenswaarde kortstondige blootstelling - Belgium 1998
EC : Indicative occupational exposure limit values - directive 2000/39/EC

Chronic toxicity:
K : List of the carcinogenic substances and processes - The Netherlands 2002
Material Safety Data Sheet
Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzo[a]pyrene, 98%

**Catalog Numbers:** AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000

**Synonyms:** 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

**Company Identification:**
- Acros Organics N.V.
- One Reagent Lane
- Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

<table>
<thead>
<tr>
<th>CAS#</th>
<th>Chemical Name</th>
<th>Percent</th>
<th>EINECS/ELINCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-32-8</td>
<td>Benzo[a]pyrene</td>
<td>&gt;96</td>
<td>200-028-5</td>
</tr>
</tbody>
</table>

Section 3 - Hazards Identification

**EMERGENCY OVERVIEW**

Appearance: yellow to brown powder.

**Danger!** May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.

**Target Organs:** Reproductive system, skin.

**Potential Health Effects**

**Eye:** May cause eye irritation.

**Skin:** May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

**Ingestion:** May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

**Inhalation:** May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

**Chronic:** May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures
**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

---

**Section 5 - Fire Fighting Measures**

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or appropriate foam.

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

---

**Section 6 - Accidental Release Measures**

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

---

**Section 7 - Handling and Storage**

**Handling:** Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

---

**Section 8 - Exposure Controls, Personal Protection**

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

**Exposure Limits**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH</th>
<th>NIOSH</th>
<th>OSHA - Final PELs</th>
</tr>
</thead>
</table>
OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder

Appearance: yellow to brown

Odor: faint aromatic odor

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 495 deg C @ 760 mm Hg

Freezing/Melting Point: 175 - 179 deg C

Decomposition Temperature: Not available.

Solubility: 1.60x10-3 mg/l @25°C

Specific Gravity/Density: Not available.

Molecular Formula: C20H12

Molecular Weight: 252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Dust generation.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#: 

CAS# 50-32-8: DJ3675000

LD50/LC50: 

https://fscimage.fishersci.com/msds/37175.htm
Not available.

**Carcinogenicity:**
CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found  
**Teratogenicity:** No information found  
**Reproductive Effects:** Adverse reproductive effects have occurred in experimental animals.  
**Mutagenicity:** Mutagenic effects have occurred in humans. Mutagenic effects have occurred in experimental animals.  
**Neurotoxicity:** No information found  
**Other Studies:**

### Section 12 - Ecological Information

No information available.

### Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.  
**RCRA P-Series:** None listed.  
**RCRA U-Series:**  
CAS# 50-32-8: waste number U022.

### Section 14 - Transport Information

<table>
<thead>
<tr>
<th>Shipping Name:</th>
<th>US DOT</th>
<th>Canada TDG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOT REGULATED FOR DOMESTIC TRANSPORT</td>
<td>ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo(a) pyrene)</td>
</tr>
<tr>
<td>Hazard Class:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN Number:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packing Group:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Section 15 - Regulatory Information

**US FEDERAL**

**TSCA**
CAS# 50-32-8 is listed on the TSCA inventory.

**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.

**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.

**Section 12b**
None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**
None of the chemicals in this material have a SNUR under TSCA.

**CERCLA Hazardous Substances and corresponding RQs**
CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

**SARA Section 302 Extremely Hazardous Substances**
None of the chemicals in this product have a TPQ.

**SARA Codes**
CAS # 50-32-8: immediate, delayed.

**Section 313**
This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

**Clean Air Act:**
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**
None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**
CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**California Prop 65**
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 50-32-8: 0.06 ñg/day NSRL

**European/International Regulations**

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

T N

**Risk Phrases:**
R 43 May cause sensitization by skin contact.
R 45 May cause cancer.
R 46 May cause heritable genetic damage.
R 60 May impair fertility.
R 61 May cause harm to the unborn child.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardous waste.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)
   CAS# 50-32-8: No information available.

Canada - DSL/NDSL
   CAS# 50-32-8 is listed on Canada's DSL List.

Canada - WHMIS
   This product has a WHMIS classification of D2A.
   This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List
   CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997
Revision #7 Date: 6/30/2006

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.
SAFETY DATA SHEET

Revision Date 10-Feb-2015
Revision Number 1

1. Identification

Product Name  Benzo[ghi]perylene
Cat No. :  AC105550000; AC105550050; AC105550250; AC105551000
Synonyms  1,12-Benzoperylene
Recommended Use  Laboratory chemicals.
Uses advised against  No Information available

2. Hazard(s) identification


Label Elements  None required

Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>191-24-2</td>
<td>&gt; 98</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact  Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact  Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.
Inhalation
Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Obtain medical attention.

Ingestion
Clean mouth with water. Get medical attention.

Most important symptoms/effects
No information available.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Unsuitable Extinguishing Media
No information available

Flash Point
No information available

Method -
No information available

Autoignition Temperature
No information available

Explosion Limits
No data available

Upper
No data available

Lower
No data available

Sensitivity to Mechanical Impact
No information available

Sensitivity to Static Discharge
No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions
See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up
Avoid dust formation. Sweep up or vacuum up spillage and collect in suitable container for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling
Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist.

Storage
Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines
This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Engineering Measures
Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment
Benzo[ghi]perylene

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>276 - 280 °C / 528.8 - 536 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>No information available &gt; @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No information available</td>
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<tr>
<td>Relative Density</td>
<td>No information available</td>
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<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
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<td>Viscosity</td>
<td>No information available</td>
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<td>Molecular Formula</td>
<td>C22 H12</td>
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<td>Molecular Weight</td>
<td>276.33</td>
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10. Stability and reactivity

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive Hazard</td>
<td>None known, based on information available</td>
</tr>
<tr>
<td>Stability</td>
<td>Stable.</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>Excess heat. Exposure to light. Incompatible products.</td>
</tr>
<tr>
<td>Incompatible Materials</td>
<td>Strong oxidizing agents</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>Carbon monoxide (CO), Carbon dioxide (CO2)</td>
</tr>
<tr>
<td>Hazardous Polymerization</td>
<td>Hazardous polymerization does not occur.</td>
</tr>
<tr>
<td>Hazardous Reactions</td>
<td>None under normal processing.</td>
</tr>
</tbody>
</table>

11. Toxicological information

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Toxicity</td>
<td></td>
</tr>
<tr>
<td>Product Information</td>
<td>No acute toxicity information is available for this product</td>
</tr>
<tr>
<td>Component Information</td>
<td></td>
</tr>
<tr>
<td>Toxicologically Synergistic</td>
<td>No information available</td>
</tr>
</tbody>
</table>
Benzo[ghi]perylene

Products
Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
No information available

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>191-24-2</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
None known

STOT - repeated exposure
None known

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability
No information available

Bioaccumulation/ Accumulation
No information available.

Mobility

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>7.23</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
Not regulated

TDG
Not regulated

IATA
Not regulated

IMDG/IMO
Not regulated

15. Regulatory information

International Inventories
### Benzo[ghi]perylene

- **CAS-No**: 191-24-2
- **Weight %**: > 98
- **SARA 313 - Threshold Values %**: 1.0

#### SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>191-24-2</td>
<td>&gt; 98</td>
<td>1.0</td>
</tr>
</tbody>
</table>

- **Acute Health Hazard**: No
- **Chronic Health Hazard**: No
- **Fire Hazard**: No
- **Sudden Release of Pressure Hazard**: No
- **Reactive Hazard**: No

#### Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- **Clean Air Act**: Not applicable
- **OSHA**: Occupational Safety and Health Administration
  - Not applicable

#### CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>5000 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

- **California Proposition 65**: This product does not contain any Proposition 65 chemicals

#### State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(ghi)perylene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

- **U.S. Department of Transportation**
  - Reportable Quantity (RQ): N
  - DOT Marine Pollutant: N
  - DOT Severe Marine Pollutant: N

- **U.S. Department of Homeland Security**
This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade**  
No information available

**Canada**  
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

**WHMIS Hazard Class**  
Non-controlled

### 16. Other information

**Prepared By**  
Regulatory Affairs  
Thermo Fisher Scientific  
Email: EMSDS.RA@thermofisher.com

**Revision Date**  
10-Feb-2015

**Print Date**  
10-Feb-2015

**Revision Summary**  
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

**Disclaimer**  
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
SAFETY DATA SHEET

1. Identification

Product Name: Benzoic acid

Cat No.: A63-500; A65-500; A68-30

Synonyms: Benzenecarboxylic acid; Benzenemethanoic acid; Phenylcarboxylic acid; Phenylformic acid; Benzenoformic acid; Carboxybenzene

Recommended Use: Laboratory chemicals.

Uses advised against: No Information available

Details of the supplier of the safety data sheet

Company: Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Skin Corrosion/irritation</th>
<th>Category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 1</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 1</td>
</tr>
<tr>
<td>Target Organs - Lungs.</td>
<td></td>
</tr>
</tbody>
</table>

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye damage
Causes damage to organs through prolonged or repeated exposure
Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Do not eat, drink or smoke when using this product
Response
Get medical attention/advice if you feel unwell
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
May form combustible dust concentrations in air

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>65-85-0</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Immediate medical attention is required.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation
Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If
not breathing, give artificial respiration. Obtain medical attention.

Ingestion
Do not induce vomiting. Obtain medical attention.

Most important symptoms/effects
Causes eye burns. Repeated or prolonged skin contact may cause allergic reactions with
susceptible persons.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media
Water spray. Carbon dioxide (CO₂). Dry chemical. chemical foam.

Unsuitable Extinguishing Media
No information available

Flash Point
121 °C / 249.8 °F
No information available

Autoignition Temperature
Not applicable 570 °C / 1058 °F

Explosion Limits
Upper
No data available
Lower
No data available

Sensitivity to Mechanical Impact
No information available

Sensitivity to Static Discharge
No information available
Benzoic acid

Revision Date 23-Jan-2015

Specific Hazards Arising from the Chemical
Dust can form an explosive mixture in air.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Use personal protective equipment. Ensure adequate ventilation.

Environmental Precautions
See Section 12 for additional ecological information.

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

7. Handling and storage

Handling
Avoid contact with skin and eyes. Avoid ingestion and inhalation. Do not breathe dust.

Storage
Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines
This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Engineering Measures
Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection
Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Off-white</td>
</tr>
<tr>
<td>Odor</td>
<td>aromatic</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>2.5-3.5  2.9 g/l water</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>121 - 123 °C / 249.8 - 253.4 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>249 °C / 480.2 °F @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>121 °C / 249.8 °F</td>
</tr>
</tbody>
</table>
10. Stability and reactivity

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid
Incompatible products. Avoid dust formation.

Incompatible Materials
Strong acids, Strong bases, Strong oxidizing agents, Strong reducing agents, Metals

Hazardous Decomposition Products
Carbon monoxide (CO), Carbon dioxide (CO₂)

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
Aqueous solution, May react with metals and lead to the formation of flammable hydrogen gas.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>1700 mg/kg ( Rat ) 2565 mg/kg ( Rat )</td>
<td>Not listed</td>
<td>26 mg/m³ ( Rat ) 1 h</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Irritation
Irritating to eyes, respiratory system and skin

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>65-85-0</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
Not mutagenic in AMES Test

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.
STOT - single exposure  None known
STOT - repeated exposure  Lungs

Aspiration hazard  No information available

Symptoms / effects, both acute and delayed  No information available

Endocrine Disruptor Information  No information available

Other Adverse Effects  The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>5 mg/L EC50 = 3 h</td>
<td>180 mg/L LC50 96 h</td>
<td>EC50 = 16.85 mg/L 30 min</td>
<td>300 mg/L EC50 = 24 h 860 mg/L EC50 = 48 h</td>
</tr>
</tbody>
</table>

Persistence and Degradability  Soluble in water. Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation  No information available.

Mobility  Is not likely mobile in the environment due to its low water solubility. Will likely be mobile in the environment due to its water solubility.

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>1.93</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods  Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT  Not regulated
TDG  Not regulated
IATA  Not regulated
IMDG/IMO  Not regulated

15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>200-618-2</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base
Production and Site Reports (40 CFR 710(B)).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.
U.S. Federal Regulations

TSCA 12(b) Not applicable
SARA 313 Not applicable

SARA 311/312 Hazardous Categorization
- Acute Health Hazard: Yes
- Chronic Health Hazard: Yes
- Fire Hazard: No
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: No

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>X</td>
<td>5000 lb</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>5000 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

California Proposition 65
This product does not contain any Proposition 65 chemicals

State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoic acid</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant: N
DOT Severe Marine Pollutant: N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
- E Corrosive material
- D2A Very toxic materials
16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 01-May-2012
Revision Date 23-Jan-2015
Print Date 23-Jan-2015
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

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End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Beryllium

Product Number : 378135
Brand : Aldrich

CAS-No. : 7440-41-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Inhalation (Category 2), H330
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Skin sensitisation (Category 1), H317
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Specific target organ toxicity - repeated exposure (Category 1), H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger

Hazard statement(s)
H301 : Toxic if swallowed.
H315 : Causes skin irritation.
H317 : May cause an allergic skin reaction.
H319 : Causes serious eye irritation.
H330 : Fatal if inhaled.
H335 : May cause respiratory irritation.
H350 : May cause cancer.
H372 Causes damage to organs through prolonged or repeated exposure.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284 Wear respiratory protection.
P301 + P310 + P330 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P333 + P313 If skin irritation or rash occurs: Get medical advice/attention.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula : Be
Molecular weight : 9.01 g/mol
CAS-No. : 7440-41-7
EC-No. : 231-150-7

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>Acute Tox. 3; Acute Tox. 2; Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; Carc. 1B; STOT SE 3; STOT RE 1; H301, H315, H317, H319, H330, H335, H350, H372</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.
4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Beryllium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Keep in a dry place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>TWA 2.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CEIL 5.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peak 25.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 2.000000 microgram per cubic meter</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td>Remarks</td>
<td>Z27.29-1970</td>
<td>CEIL 5.000000 microgram per cubic meter</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z27.29-1970</td>
<td>Peak 25.000000 microgram per cubic meter</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z27.29-1970</td>
<td>TWA 0.000050 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
</tbody>
</table>

Beryllium sensitization  
Chronic beryllium disease (berylliosis)  
Confirmed human carcinogen  
Danger of cutaneous absorption  
Sensitizer  

C  
0.000500 mg/m³  USA. NIOSH Recommended Exposure Limits  
Potential Occupational Carcinogen  
See Appendix A  
See Table Z-2  

TWA 2.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
TWA 2.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
CEIL 5.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
CEIL 5.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
Peak 25.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
Peak 25.000000 microgram per cubic meter  USA. Occupational Exposure Limits (OSHA) - Table Z-2  
Z27.29-1970  
TWA 0.000050 mg/m³  USA. ACGIH Threshold Limit Values (TLV)  
Beryllium sensitization
### Chronic beryllium disease (berylliosis)
Adopted values or notations enclosed are those for which changes are proposed in the NIC
See Notice of Intended Changes (NIC)
Confirmed human carcinogen
Danger of cutaneous absorption
Sensitizer

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.000500 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

Potential Occupational Carcinogen
See Appendix A

<table>
<thead>
<tr>
<th></th>
<th>USA. Occupational Exposure Limits (OSHA) - Table Z-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>2 microgram per cubic meter</td>
</tr>
<tr>
<td>CEIL</td>
<td>5 microgram per cubic meter</td>
</tr>
<tr>
<td>Peak</td>
<td>25 microgram per cubic meter</td>
</tr>
</tbody>
</table>

### Exposure controls

**Appropriate engineering controls**
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Full contact**
- Material: Nitrile rubber
- Minimum layer thickness: 0.11 mm
- Break through time: 480 min
- Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

**Splash contact**
- Material: Nitrile rubber
- Minimum layer thickness: 0.11 mm
- Break through time: 480 min
- Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

a) Appearance
   Form: powder
   Colour: grey

b) Odour
   odourless

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: 1,278 °C (2,332 °F) - lit.

f) Initial boiling point and boiling range
   2,970 °C (5,378 °F) - lit.

g) Flash point
   No data available

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   No data available

k) Vapour pressure
   No data available

l) Vapour density
   No data available

m) Relative density
   1.85 g/cm3 at 25 °C (77 °F)

n) Water solubility
   No data available

o) Partition coefficient: n-octanol/water
   No data available

p) Auto-ignition temperature
   No data available

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

**9.2 Other safety information**
No data available

---

**10. STABILITY AND REACTIVITY**

**10.1 Reactivity**
No data available

**10.2 Chemical stability**
Stable under recommended storage conditions.

**10.3 Possibility of hazardous reactions**
No data available
10.4 **Conditions to avoid**
No data available

10.5 **Incompatible materials**
Alkali metals

10.6 **Hazardous decomposition products**
Other decomposition products - No data available
In the event of fire: see section 5

11. **TOXICOLOGICAL INFORMATION**

11.1 **Information on toxicological effects**

**Acute toxicity**
No data available

*Inhalation:* No data available

*Dermal:* No data available

*LD50 Intravenous - Rat:* 0.496 mg/kg

*Remarks:* Liver: Hepatitis (hepatocellular necrosis), zonal.

**Skin corrosion/irritation**
No data available

**Serious eye damage/eye irritation**
No data available

**Respiratory or skin sensitisation**
No data available

**Germ cell mutagenicity**
Hamster
Lungs
Result: negative

**Carcinogenicity**
Carcinogenicity - *Rat - Intratracheal*
Tumorigenic: Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration: Tumors. Lungs, Thorax, or Respiration: Bronchiogenic carcinoma.

Carcinogenicity - *Rabbit - Intravenous*
Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal: Tumors.

Possible human carcinogen

*IARC:* 1 - Group 1: Carcinogenic to humans (Beryllium foil)

*NTP:* Known to be human carcinogen (Beryllium foil)

Known to be human carcinogen

*The reference note has been added by TD based on the background information of the NTP. (Beryllium foil)*

*OSHA:* No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

No data available

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available
12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1567  Class: 6.1 (4.1)  Packing group: II
Proper shipping name: Beryllium, powder
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1567  Class: 6.1 (4.1)  Packing group: II  EMS-No: F-G, S-G
Proper shipping name: BERYLLIUM POWDER

IATA
UN number: 1567  Class: 6.1 (4.1)  Packing group: II
Proper shipping name: Beryllium powder

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium foil</td>
<td>7440-41-7</td>
<td>2008-10-10</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| Acute Tox. | Acute toxicity |
| Carc.      | Carcinogenicity |
| Eye Irrit. | Eye irritation  |
| H301       | Toxic if swallowed. |
| H315       | Causes skin irritation. |
| H317       | May cause an allergic skin reaction. |
| H319       | Causes serious eye irritation. |
| H330       | Fatal if inhaled. |
| H335       | May cause respiratory irritation. |
| H350       | May cause cancer. |
| H372       | Causes damage to organs through prolonged or repeated exposure. |
| Skin Irrit.| Skin irritation |
| Skin Sens.| Skin sensitisation |

HMIS Rating

- Health hazard: 4
- Chronic Health Hazard: *
- Flammability: 0
- Physical Hazard: 0

NFPA Rating

- Health hazard: 4
- Fire Hazard: 3
- Reactivity Hazard: 3

Further Information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name : β-HCH
Product Number : 33376
Brand : Sigma-Aldrich
Index-No. : 602-042-00-0
CAS-No. : 319-85-7

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word Danger

Hazard statement(s)
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P322 Specific measures (see supplemental first aid instructions on this label).
P330 Rinse mouth.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula : C₆H₆Cl₆
Molecular weight : 290.83 g/mol
CAS-No. : 319-85-7
EC-No. : 206-271-3
Index-No. : 602-042-00-0

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane</td>
<td>Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
5. FIREFIGHTING MEASURES

5.1 Extinguishing media
   Suitable extinguishing media
   Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
   No data available

5.3 Advice for firefighters
   Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
   No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
   Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
   Evacuate personnel to safe areas. Avoid breathing dust.
   For personal protection see section 8.

6.2 Environmental precautions
   Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
   Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
   For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
   Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
   Provide appropriate exhaust ventilation at places where dust is formed.
   For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
   Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
   Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
   Components with workplace control parameters
   Contains no substances with occupational exposure limit values.

8.2 Exposure controls
   Appropriate engineering controls
   Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

   Personal protective equipment
      Eye/face protection
      Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

      Skin protection
      Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.
Full contact  
Material: Nitrile rubber  
Minimum layer thickness: 0.11 mm  
Break through time: 480 min  
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)  

Splash contact  
Material: Nitrile rubber  
Minimum layer thickness: 0.11 mm  
Break through time: 480 min  
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)  

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374  
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.  

Body Protection  
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.  

Respiratory protection  
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).  

Control of environmental exposure  
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.  

9. PHYSICAL AND CHEMICAL PROPERTIES  
9.1 Information on basic physical and chemical properties  
a) Appearance  
Form: solid  
Colour: colourless  
b) Odour  
No data available  
c) Odour Threshold  
No data available  
d) pH  
No data available  
e) Melting point/freezing point  
> 300.0 °C (> 572.0 °F)  
f) Initial boiling point and boiling range  
No data available  
g) Flash point  
No data available  
h) Evaporation rate  
No data available  
i) Flammability (solid, gas)  
No data available  
j) Upper/lower flammability or explosive limits  
No data available  
k) Vapour pressure  
No data available  
l) Vapour density  
No data available  
m) Relative density  
No data available  
n) Water solubility  
insoluble  
o) Partition coefficient: n- log Pow: 3.78
octanol/water

p) Auto-ignition temperature  No data available
q) Decomposition temperature  No data available
r) Viscosity  No data available
s) Explosive properties  No data available
t) Oxidizing properties  No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 6,000 mg/kg
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.
Limited evidence of carcinogenicity in animal studies
IARC: 2B - Group 2B: Possibly carcinogenic to humans \((1\alpha,2\beta,3\alpha,4\beta,5\alpha,6\beta)-1,2,3,4,5,6-
Hexachlorocyclohexane\)

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a
carcinogen or potential carcinogen by ACGIH.

NTP: Reasonably anticipated to be a human carcinogen \((1\alpha,2\beta,3\alpha,4\beta,5\alpha,6\beta)-1,2,3,4,5,6-
Hexachlorocyclohexane\)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a
carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

No data available

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**

RTECS: GV4375000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly

**ECOLOGICAL INFORMATION**

12.1 **Toxicity**
Toxicity to fish  
LC50 - Poecilia reticulata (guppy) - 1.6 mg/l - 96.0 h

12.2 **Persistence and degradability**
No data available

12.3 **Bioaccumulative potential**
Bioaccumulation  
Cyprinus carpio (Carp) - 35 d  
- 0.05 mg/l

Bioconcentration factor (BCF): 500

12.4 **Mobility in soil**
No data available

12.5 **Results of PBT and vPvB assessment**
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 **Other adverse effects**
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.  
Very toxic to aquatic life with long lasting effects.

13. **DISPOSAL CONSIDERATIONS**

13.1 **Waste treatment methods**

**Product**
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste
disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a
chemical incinerator equipped with an afterburner and scrubber.

**Contaminated packaging**
Dispose of as unused product.
14. TRANSPORT INFORMATION

DOT (US)
UN number: 2811   Class: 6.1   Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811   Class: 6.1   Packing group: III   EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

IATA
UN number: 2811   Class: 6.1   Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.

CAS-No. 319-85-7
Revision Date 2009-02-01

(1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Acute toxicity
Aquatic Acute Acute aquatic toxicity
Aquatic Chronic Chronic aquatic toxicity
Carc. Carcinogenicity
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.

HMIS Rating
Health hazard: 2
Chronic Health Hazard: *
Flammability: 0
Physical Hazard 0

NFPA Rating
Health hazard: 1
Fire Hazard: 0
Reactivity Hazard: 0
Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.6 Revision Date: 05/23/2016 Print Date: 06/22/2017
### Section I: Product Identification

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2600,4230,4232,4233</td>
<td>BTEX</td>
</tr>
</tbody>
</table>

### Section II - Hazardous Ingredients/Identity Information

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Reg. No.</th>
<th>OSHA PEL (TWA)</th>
<th>% Composition*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>67-56-1</td>
<td>200 ppm</td>
<td>&gt;90%</td>
</tr>
</tbody>
</table>

A table of the compounds possible in this purgeable aromatic analytical standard is attached. Data included in the table are formulas, CAS numbers, oral LD50 values for rats and PEL/TWA values if available. Total concentration of purgeable aromatic compounds in the standard is less than 2% with individual compound concentrations of less than 0.1%.

### Non-Hazardous Ingredients/Identity Information

* Components are calculated on a weight/weight basis.

### Section III - Physical/Chemical Characteristics of Hazardous Ingredients

- **Boiling Point:** 65 °C (149 °F)
- **Specific Gravity:** (water=1) 0.79
- **Vapor Pressure:** 97 mmHg @ 20 °C
- **Solubility in Water:** Complete
- **Appearance/Odor:** Clear, colorless liquid with pungent odor (methanol).

### Section IV - Fire and Explosion Hazard Data

- **Flash Point:** 12 °C (54 °F) Closed cup
- **Auto Ignition Temperature:** 463 °C (867 °F)
- **Flammable Limits:** LEL 6% UEL 36%
- **Extinguishing Media:** Use extinguisher media appropriate for surrounding fire since sample size is small. Alcohol foam, dry chemical or carbon dioxide (water may be ineffective in most laboratory situations.)
- **Special Fire Fighting Procedures:** Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire exposed containers cool.
- **Unusual Fire and Explosion Hazards:** Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Burns with a clear, almost invisible flame.

### Section V - Reactivity Data

- **Stability:** Unstable ☐ Stable ☑
- **Conditions to Avoid:** Heat, flame and other sources of ignition.
- **Incompatibility (Materials to avoid):** String oxidizing agents, strong acids, zinc, aluminum and magnesium.
- **Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide and formaldehyde.
- **Hazardous Polymerization:** May Occur ☐ Will Not Occur ☑
- **Conditions to Avoid:** N/A
Section VI - Health Hazard Data

<table>
<thead>
<tr>
<th>ROUTES OF ENTRY</th>
<th>Inhalation? YES</th>
<th>Skin? YES</th>
<th>Ingestion? YES</th>
</tr>
</thead>
</table>

HEALTH HAZARDS (Acute and Chronic): ACUTE: Yes, see chronic symptoms. CHRONIC: Yes, methanol ingestion may be fatal or cause blindness, headache, nausea, vomiting, dizziness, gastrointestinal irritation, central nervous system depression or hearing loss.

COMPONENTS LISTED AS CARCINOGENS OR POTENTIAL CARCINOGENS: No, not listed in IARC monograph.

SIGNS AND SYMPTOMS OF EXPOSURE: Irritation of skin, eyes, nose, throat and headache. Prolonged contact may cause dermatitis. Exposure effects may differ between individuals.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Eye disorders, skin disorders, liver and kidney disorders.

EMERGENCY AND FIRST AID PROCEDURES: Seek medical assistance for treatment, observation and support if necessary. EYE CONTACT: Flush with water, obtain medical attention. SKIN CONTACT: Wash with soap and water, use protective creams. INHALATION: Remove to fresh air, if not breathing give artificial respiration. If breathing is difficult, give oxygen and obtain medical attention. INGESTION: If conscious, give water and baking soda and induce vomiting. Obtain medical assistance immediately.

Section VII - Precautions for Safe Handling and Use

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: (Sample) shut off ignition sources. No flares, smoking or flames in area. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

WASTE DISPOSAL METHOD: Dispose in accordance with all applicable federal, state and local environmental regulations. Excess sample should be placed in a proper waste solvent container.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep container tightly closed, store in a cool, dry, well ventilated, flammable liquid storage area.

OTHER PRECAUTIONS*: Do not heat or evaporate sample to dryness.

Section VIII - Control Measures

RESPIRATORY PROTECTION (Please specify): Required if airborne concentration exceeds TWA of 200 ppm.

VENTILATION: Local exhaust. (general or local exhausts meet TLV regulations).

PROTECTIVE GLOVES: Rubber gloves recommended. EYE PROTECTION: Safety glasses or goggles.

OTHER PROTECTIVE EQUIPMENT: N/A

EMERGENCY WASH FACILITIES: Maintain eye wash and quick drench showers in work area.

The information stated in this Material Safety Data Sheet (MSDS) is believed to be correct on the date of publication and must not be considered all conclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. Persons not specifically and properly trained should not handle this chemical or its container. This MSDS is provided without any warranty expressed or implied, including merchantability or fitness for any particular purpose.

This product is furnished for laboratory use ONLY! Our standards may not be used as drugs, cosmetics, agricultural or pesticidal products, food additives or as house hold chemicals.

* Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Environmental Protection Agency, and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.
Hazardous components of the Volatiles Standard

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>CAS #</th>
<th>% by WEIGHT</th>
<th>LD50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylbenzene</td>
<td>100-41-4</td>
<td>&lt;0.2%</td>
<td>3500 mg/kg</td>
</tr>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>&lt;0.2%</td>
<td>4894 mg/kg</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>&lt;0.2%</td>
<td>7000 mg/kg</td>
</tr>
<tr>
<td>m-Xylene</td>
<td>108-38-3</td>
<td>&lt;0.2%</td>
<td>5 gm/kg</td>
</tr>
<tr>
<td>p-Xylene</td>
<td>106-42-3</td>
<td>&lt;0.2%</td>
<td>5 gm/kg</td>
</tr>
<tr>
<td>o-Xylene</td>
<td>95-47-6</td>
<td>&lt;0.2%</td>
<td>1364 mg/kg</td>
</tr>
</tbody>
</table>
Material Safety Data Sheet
Cadmium MSDS

Section 1: Chemical Product and Company Identification

| Product Name: | Cadmium |
| Catalog Codes: | SLC3484, SLC5272, SLC2482 |
| CAS#: | 7440-43-9 |
| RTECS: | EU9800000 |
| TSCA: | TSCA 8(b) inventory: Cadmium |
| CI#: | Not applicable. |
| Synonym: | Chemical Name: Cadmium |
| Chemical Formula: | Cd |

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium</td>
<td>7440-43-9</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, liver. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

p. 1
Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage
Precautions:
Keep locked up. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)
Odor: Not available.
Taste: Not available.
Molecular Weight: 112.4 g/mole
Color: Silvery.
pH (1% soln/water): Not applicable.
Boiling Point: 765°C (1409°F)
Melting Point: 320.9°C (609.6°F)
Critical Temperature: Not available.
Specific Gravity: 8.64 (Water = 1)
Vapor Pressure: Not applicable.
Vapor Density: Not available.
Volatility: Not available.
Odor Threshold: Not available.
Water/Oil Dist. Coeff.: Not available.
Ionicity (in Water): Not available.
Dispersion Properties: Not available.
Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

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**Section 10: Stability and Reactivity Data**

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

**Corrosivity:** Not considered to be corrosive for metals and glass.

**Special Remarks on Reactivity:** Reacts violently with potassium.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

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**Section 11: Toxicological Information**

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 890 mg/kg [Mouse]. Acute toxicity of the dust (LC50): 229.9 mg/m³ 4 hour(s) [Rat].

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver.

**Other Toxic Effects on Humans:**
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

**Special Remarks on other Toxic Effects on Humans:** May cause allergic reactions, exzema and/or dehydration of the skin.

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**Section 12: Ecological Information**

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

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**Section 13: Disposal Considerations**

**Waste Disposal:**

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**Section 14: Transport Information**
Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium Pennsylvania RTK: Cadmium Massachusetts RTK: Cadmium TSCA 8(b) inventory: Cadmium SARA 313 toxic chemical notification and release reporting: Cadmium CERCLA: Hazardous substances.: Cadmium


**Other Classifications:**
WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R26- Very toxic by inhalation. R45- May cause cancer.

HMIS (U.S.A.):
- **Health Hazard:** 3
- **Fire Hazard:** 1
- **Reactivity:** 0

**Personal Protection:** E

National Fire Protection Association (U.S.A.):
- **Health:** 3
- **Flammability:** 1
- **Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

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Section 16: Other Information

**References:**

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:29 PM
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Material Safety Data Sheet
Calcium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium
Catalog Codes: SLC2782
CAS#: 7440-70-2
RTECS: EV8040000
TSCA: TSCA 8(b) inventory: Calcium
Cl#: Not available.
Synonym:
Chemical Formula: Ca

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>7440-70-2</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Calcium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures
**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

**Serious Skin Contact:**
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:**
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

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### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

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### Section 6: Accidental Release Measures

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:**
Corrosive solid. Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

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### Section 7: Handling and Storage
Precautions:
Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as acids, moisture.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.
Odor: Not available.
Taste: Not available.
Molecular Weight: 40.08 g/mole
Color: Not available.
pH (1% soln/water): Not available.
Boiling Point: 1484°C (2703.2°F)
Melting Point: 839°C (1542.2°F)
Critical Temperature: Not available.
Specific Gravity: 1.54 (Water = 1)
Vapor Pressure: Not applicable.
Vapor Density: Not available.
Volatility: Not available.
Odor Threshold: Not available.
Water/Oil Dist. Coeff.: Not available.
Ionicity (in Water): Not available.
Dispersion Properties: Not available.
### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:**
Highly reactive with acids. Reactive with moisture. The product reacts violently with water to emit flammable but non-toxic gases.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

### Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**
LD50: Not available. LC50: Not available.

**Chronic Effects on Humans:** The substance is toxic to lungs, mucous membranes.

**Other Toxic Effects on Humans:** Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:** Not available.

### Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information

**DOT Classification:** CLASS 4.3: Material that emits flammable gases on contact with water.
**Section 15: Other Regulatory Information**

**Federal and State Regulations:**
Pennsylvania RTK: Calcium Massachusetts RTK: Calcium TSCA 8(b) inventory: Calcium


**Other Classifications:**

**WHMIS (Canada):**
CLASS B-6: Reactive and very flammable material. CLASS E: Corrosive solid.

**DSCL (EEC):** R36/38- Irritating to eyes and skin.

**HMIS (U.S.A.):**
- Health Hazard: 3
- Fire Hazard: 3
- Reactivity: 2
- Personal Protection: j

**National Fire Protection Association (U.S.A.):**
- Health: 3
- Flammability: 3
- Reactivity: 2
- Specific hazard:

**Protective Equipment:**
Gloves. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

---

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/11/2005 11:30 AM

**Last Updated:** 05/21/2013 12:00 PM

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1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Carbazole
Product Number : C5132
Brand : Sigma
CAS-No. : 86-74-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 2), H351
Chronic aquatic toxicity (Category 4), H413

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Warning

Hazard statement(s)
H351 : Suspected of causing cancer.
H413 : May cause long lasting harmful effects to aquatic life.

Precautionary statement(s)
P201 : Obtain special instructions before use.
P202 : Do not handle until all safety precautions have been read and understood.
P273 : Avoid release to the environment.
P281 : Use personal protective equipment as required.
P308 + P313 : IF exposed or concerned: Get medical advice/ attention.
P405 : Store locked up.
P501 : Dispose of contents/ container to an approved waste disposal plant.
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula: $\text{C}_12\text{H}_9\text{N}$
Molecular weight: 167.21 g/mol
CAS-No.: 86-74-8
EC-No.: 201-696-0

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbazole</td>
<td>Carc. 2; Aquatic Chronic 4; H351, H413</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Nitrogen oxides (NOx)

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
6.3 **Methods and materials for containment and cleaning up**
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 **Reference to other sections**
For disposal see section 13.

---

**7. HANDLING AND STORAGE**

7.1 **Precautions for safe handling**
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 **Conditions for safe storage, including any incompatibilities**
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

8.1 **Control parameters**

*Components with workplace control parameters*
Contains no substances with occupational exposure limit values.

8.2 **Exposure controls**

*Appropriate engineering controls*
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

*Personal protective equipment*

**Eye/face protection**
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.
**Body Protection**
Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Appearance</td>
<td>Form: powder Colour: beige</td>
</tr>
<tr>
<td>b) Odour</td>
<td>No data available</td>
</tr>
<tr>
<td>c) Odour Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d) pH</td>
<td>No data available</td>
</tr>
<tr>
<td>e) Melting point/freezing point</td>
<td>Melting point/range: 243 - 246 °C (469 - 475 °F)</td>
</tr>
<tr>
<td>f) Initial boiling point and boiling range</td>
<td>355 °C (671 °F)</td>
</tr>
<tr>
<td>g) Flash point</td>
<td>220.0 °C (428.0 °F) - closed cup</td>
</tr>
<tr>
<td>h) Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>i) Flammability (solid, gas)</td>
<td>The product is not flammable.</td>
</tr>
<tr>
<td>j) Upper/lower flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>k) Vapour pressure</td>
<td>533 hPa (400 mmHg) at 323 °C (613 °F)</td>
</tr>
<tr>
<td>l) Vapour density</td>
<td>No data available</td>
</tr>
<tr>
<td>m) Relative density</td>
<td>1.1 g/cm³ at 18 °C (64 °F)</td>
</tr>
<tr>
<td>n) Water solubility</td>
<td>0.00091 g/l at 25 °C (77 °F)</td>
</tr>
<tr>
<td>o) Partition coefficient: n-octanol/water</td>
<td>log Pow: 3.72 at 22 °C (72 °F)</td>
</tr>
<tr>
<td>p) Auto-ignition temperature</td>
<td>&gt; 600 °C (&gt; 1,112 °F) at 1,013 hPa (760 mmHg)</td>
</tr>
<tr>
<td>q) Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>r) Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>s) Explosive properties</td>
<td>No data available</td>
</tr>
<tr>
<td>t) Oxidizing properties</td>
<td>No data available</td>
</tr>
</tbody>
</table>

#### 9.2 Other safety information
No data available

---

### 10. STABILITY AND REACTIVITY

#### 10.1 Reactivity
No data available
10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD0 Oral - Rat - > 16,000 mg/kg
(OECD Test Guideline 401)
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/Irritation
Skin - Rabbit
Result: No skin irritation
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
Carcinogenicity - Mouse - male and female - Oral
hepatocellular carcinoma
Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Carbazole)
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available
Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: FE3150000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish
LC50 - Pimephales promelas (fathead minnow) - > 0.93 mg/l - 96.0 h
Remarks: No toxicity at the limit of solubility

Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 2.30 - 4.90 mg/l - 48 h
Remarks: No toxicity at the limit of solubility

Toxicity to algae
Growth inhibition NOEC - Scenedesmus acuminatus - > 0.4 mg/l - 96 h
Remarks: No toxicity at the limit of solubility

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation
Cyprinus carpio (Carp) - 42 d
- 0.05 mg/l

Bioconcentration factor (BCF): 241
Cyprinus carpio (Carp) - 42 d
- 0.005 mg/l

Bioconcentration factor (BCF): 200

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods
IMDG
UN number: 3077   Class: 9   Packing group: III   EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Carbazole)
Marine pollutant:yes

IATA
UN number: 3077   Class: 9   Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Carbazole)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbazole</td>
<td>86-74-8</td>
<td>2009-07-17</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbazole</td>
<td>86-74-8</td>
<td>2009-07-17</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbazole</td>
<td>86-74-8</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Chronic  Chronic aquatic toxicity
Carc.  Carcinogenicity
H351  Suspected of causing cancer.
H413  May cause long lasting harmful effects to aquatic life.

HMIS Rating
Health hazard: 2
Chronic Health Hazard: 0
Flammability: 0
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 0
Reactivity Hazard: 0
Health hazard: 2
Fire Hazard: 1
Reactivity Hazard: 0
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name : Carbon disulfide
Product Number : 180173
Brand : Sigma-Aldrich
Index-No. : 006-003-00-3
CAS-No. : 75-15-0

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Acute toxicity, Inhalation (Category 4), H332
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372
Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger

Hazard statement(s)
H225 : Highly flammable liquid and vapour.
H315 : Causes skin irritation.
H319 : Causes serious eye irritation.
H332 : Harmful if inhaled.
H361 : Suspected of damaging fertility or the unborn child.
H372 : Causes damage to organs through prolonged or repeated exposure if inhaled.
Toxic to aquatic life.

Precautionary statement(s)

P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P332 + P313 If skin irritation persists: Get medical advice/attention.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>Molecular weight</th>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS₂</td>
<td>76.14 g/mol</td>
<td>75-15-0</td>
<td>200-843-6</td>
<td>006-003-00-3</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulphide</td>
<td>Flam. Liq. 2; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Repir. 2; STOT RE 1; Aquatic Acute 2; H225, H315, H319, H332, H361, H372, H401</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.
4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Sulphur oxides
Flash back possible over considerable distance., Container explosion may occur under fire conditions., Vapours may form explosive mixture with air., May explode when heated.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Refrigerate before opening.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSOAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulphide</td>
<td>75-15-0</td>
<td>TWA</td>
<td>1 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remarks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Peripheral Nervous System impairment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Substances for which there is a Biological Exposure Index or Indices (see BEI® section)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not classifiable as a human carcinogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Danger of cutaneous absorption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>1.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remarks</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Peripheral Nervous System impairment</td>
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<td></td>
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<td></td>
<td></td>
<td>Not classifiable as a human carcinogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Danger of cutaneous absorption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>20.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
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<td>Remarks</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>CEIL</td>
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<td></td>
<td></td>
<td>30.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
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</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Peak</td>
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<td></td>
<td>100.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
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<td></td>
<td></td>
<td></td>
<td>TWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.000000 ppm</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
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<tr>
<td></td>
<td></td>
<td>3.000000 mg/m3</td>
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<td>Potential for dermal absorption</td>
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<td>USA. NIOSH Recommended Exposure Limits</td>
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<tr>
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<td>30.000000 mg/m3</td>
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<td>See Table Z-2</td>
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</tr>
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<td>TWA</td>
<td>20 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
</tr>
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<td>Remarks</td>
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<td>CEIL</td>
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<td></td>
<td></td>
<td>30 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
<td></td>
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<td></td>
<td>Remarks</td>
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<td>Z37.3-1968</td>
</tr>
</tbody>
</table>

Sigma-Aldrich • 180173 Page 4 of 10
Peak 100 ppm USA. Occupational Exposure Limits (OSHA) - Table Z-2

Z37.3-1968

### Biological occupational exposure limits

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulfide</td>
<td>75-15-0</td>
<td>2-Thiothiazolidine-4-carboxylic acid (TTCA)</td>
<td>0.5000 mg/g</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
</tr>
</tbody>
</table>

Remarks: End of shift (As soon as possible after exposure ceases)

8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

- **Full contact**
  - Material: Fluorinated rubber
  - Minimum layer thickness: 0.7 mm
  - Break through time: 480 min
  - Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

- **Splash contact**
  - Material: Fluorinated rubber
  - Minimum layer thickness: 0.7 mm
  - Break through time: 480 min
  - Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: liquid
   Colour: colourless

b) Odour
   Stench.

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: -112 °C (-170 °F) - lit.

f) Initial boiling point and boiling range
   46 °C (115 °F) - lit.

g) Flash point
   -30 °C (-22 °F) - closed cup

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   Upper explosion limit: 50 % (V)
   Lower explosion limit: 1.3 % (V)

k) Vapour pressure
   394.956 hPa (296.241 mmHg) at 20 °C (68 °F)
   1,342.711 hPa (1,007.116 mmHg) at 55 °C (131 °F)

l) Vapour density
   2.63 - (Air = 1.0)

m) Relative density
   1.266 g/mL at 25 °C (77 °F)

n) Water solubility
   2.9 g/l at 20 °C (68 °F) - OECD Test Guideline 105

o) Partition coefficient: n-octanol/water
   log Pow: 2.7 at 25 °C (77 °F)

p) Auto-ignition temperature
   97 - 107 °C (207 - 225 °F)

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information

Surface tension
   71.9 mN/m at 19.5 °C (67.1 °F)

Relative vapour density
   2.63 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   Vapours may form explosive mixture with air.

10.4 Conditions to avoid
   Heat, flames and sparks.

10.5 Incompatible materials
   Alkali metals, Zinc, Amines, Azides, Oxidizing agents
10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - female - > 2,000 mg/kg
(OECD Test Guideline 423)
LC50 Inhalation - Rat - male and female - 4 h - 10.35 mg/l
(OECD Test Guideline 403)
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
- Mouse
Result: Does not cause skin sensitisation.
(OECD Test Guideline 429)

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
Ames test
Salmonella typhimurium
Result: negative

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Suspected human reproductive toxicant
May cause reproductive disorders.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: FF6650000
May cause convulsions.
Liver - Irregularities - Based on Human Evidence
Liver - Irregularities - Based on Human Evidence
12. ECOLOGICAL INFORMATION

12.1 Toxicity

- **Toxicity to fish**
  LC50 - Poecilia reticulata (guppy) - 4 mg/l - 96 h
  (OECD Test Guideline 203)

- **Toxicity to daphnia and other aquatic invertebrates**
  Immobilization EC50 - Daphnia magna (Water flea) - 2.1 mg/l - 48 h
  (OECD Test Guideline 202)

- **Toxicity to algae**
  Growth inhibition EC50 - Chlorella pyrenoidosa - 21 mg/l - 96 h
  (OECD Test Guideline 201)

12.2 Persistence and degradability

- **Biodegradability**
  aerobic - Exposure time 28 d
  Result: > 80 % - Readily biodegradable
  (OECD Test Guideline 301D)

12.3 Bioaccumulative potential

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

- **Product**
  Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

- **Contaminated packaging**
  Dispose of as unused product.

14. TRANSPORT INFORMATION

**DOT (US)**

- UN number: 1131  Class: 3 (6.1)  Packing group: I
- Proper shipping name: Carbon disulfide
- Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

**IMDG**

- UN number: 1131  Class: 3 (6.1)  Packing group: I
- Proper shipping name: CARBON DISULPHIDE
- EMS-No: F-E, S-D

**IATA**

- UN number: 1131  Class: 3 (6.1)
- Proper shipping name: Carbon disulphide
- IATA Passenger: Not permitted for transport
- IATA Cargo: Not permitted for transport
15. REGULATORY INFORMATION

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulphide</td>
<td>75-15-0</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulphide</td>
<td>75-15-0</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon disulphide</td>
<td>75-15-0</td>
<td>2007-07-01</td>
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</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
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<tr>
<td>Carbon disulphide</td>
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</table>

New Jersey Right To Know Components

<table>
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<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
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<td>2007-07-01</td>
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</tbody>
</table>

California Prop. 65 Components

<table>
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<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
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<tr>
<td>Carbon disulphide</td>
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<td>2008-06-17</td>
</tr>
</tbody>
</table>

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- **Acute Tox.** Acute toxicity
- **Aquatic Acute** Acute aquatic toxicity
- **Eye Irrit.** Eye irritation
- **Flam. Liq.** Flammable liquids
- **H225** Highly flammable liquid and vapour.
- **H315** Causes skin irritation.
- **H319** Causes serious eye irritation.
- **H332** Harmful if inhaled.
- **H361** Suspected of damaging fertility or the unborn child.
- **H372** Causes damage to organs through prolonged or repeated exposure if inhaled.
- **H401** Toxic to aquatic life.
- **Repr.** Reproductive toxicity

**HMIS Rating**
- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 3
- Physical Hazard: 0

**NFPA Rating**
- Health hazard: 2
- Fire Hazard: 3
- Reactivity Hazard: 0
Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.6 Revision Date: 12/10/2015 Print Date: 02/09/2016
Material Safety Data Sheet
Chromium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chromium
Catalog Codes: SLC4711, SLC3709
CAS#: 7440-47-3
RTECS: GB4200000
TSCA: TSCA 8(b) inventory: Chromium
CI#: Not applicable.
Synonym: Chromium metal; Chrome; Chromium Metal Chips 2" and finer
Chemical Name: Chromium
Chemical Formula: Cr

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

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<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
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<tbody>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>100</td>
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</table>

Toxicological Data on Ingredients: Chromium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal,) by ACGIH, 3 (Not classifiable for human,) by IARC.
MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, lungs, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

**Skin Contact:**
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Serious Skin Contact:**
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

**Inhalation:**
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

**Serious Ingestion:** Not available.

### Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** 580°C (1076°F)

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:**
Slightly flammable to flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:**
Moderate fire hazard when it is in the form of a dust (powder) and burns rapidly when heated in flame. Chromium is attacked vigorously by fused potassium chlorate producing vivid incandescence. Pyrophoric chromium unites with nitric oxide with incandescence. Incandescent reaction with nitrogen oxide or sulfur dioxide.

**Special Remarks on Explosion Hazards:**
Powdered Chromium metal +fused ammonium nitrate may react violently or explosively. Powdered Chromium will explode spontaneously in air.

### Section 6: Accidental Release Measures

**Small Spill:**
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, alkalis.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area.

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:**
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**
TWA: 0.5 (mg/m³) from ACGIH (TLV) [United States] TWA: 1 (mg/m³) from OSHA (PEL) [United States] TWA: 0.5 (mg/m³) from NIOSH [United States] TWA: 0.5 (mg/m³) [United Kingdom (UK)] TWA: 0.5 (mg/m³) [Canada] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Metal solid.)

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 52 g/mole

**Color:** Silver-white to Grey.

**pH (1% soln/water):** Not applicable.

**Boiling Point:** 2642°C (4787.6°F)

**Melting Point:** 1900°C (3452°F) +/- 10 deg. C

**Critical Temperature:** Not available.

**Specific Gravity:** 7.14 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.
Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water. Soluble in acids (except Nitric), and strong alkalies.

---

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Not available.

Special Remarks on Reactivity:
Incompatible with molten Lithium at 180 deg. C, hydrogen peroxide, hydrochloric acid, sulfuric acid, most caustic alkalies and alkali carbonates, potassium chlorate, sulfur dioxide, nitrogen oxide, bromine pentafluoride. It may react violently or ignite with bromine pentafluoride. Chromium is rapidly attacked by fused sodium hydroxide + potassium nitrate. Potentially hazardous incompatibility with strong oxidizers.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

---

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause cancer based on animal data. There is no evidence that exposure to trivalent chromium causes cancer in man.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: May cause skin irritation. Eyes: May cause mechanical eye irritation. Inhalation: May cause irritation of the respiratory tract and mucus membranes of the respiratory tract. Ingestion: May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea. Chronic Potential Health Effects: Inhalation: The effects of chronic exposure include irritation, sneezing, reddness of the throat, bronchospasm, asthma, cough, polyps, chronic inflammation, emphysema, chronic bronchitis, pharyngitis, bronchopneumonia, pneumoconiosis. Effects on the nose from chronic chromium exposure include irritation, ulceration, and perforation of the nasal septum. Inflammation and ulceration of the larynx may also occur. Ingestion or Inhalation: Chronic exposure may cause liver and kidney damage.

---

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.
Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).
Identification: Not applicable.
Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Other Regulations:

Other Classifications:
WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
R40- Limited evidence of carcinogenic effect S36/37/39- Wear suitable protective clothing, gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):
  Health Hazard: 2
  Fire Hazard: 1
  Reactivity: 0
  Personal Protection: E

National Fire Protection Association (U.S.A.):
  Health: 2
  Flammability: 1
  Reactivity: 0
  Specific hazard:
Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

<table>
<thead>
<tr>
<th>Section 16: Other Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>References:</strong> Not available.</td>
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<td><strong>Other Special Considerations:</strong> Not available.</td>
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<td><strong>Created:</strong> 10/10/2005 08:16 PM</td>
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<td><strong>Last Updated:</strong> 11/06/2008 12:00 PM</td>
</tr>
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</table>

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SAFETY DATA SHEET

Based on Directive 2001/58/EC of the Commission of the European Communities

CHRYSENE

1.  Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms: none
CAS No. : 218-01-9  BCR number : BCR-269
EC index No. : 601-048-00-0  NFPA code : N.D.
EINECS No. : 205-923-4  Molecular weight : 228.30
RETECS No. : GG0700000  Formula : C18H12

1.2 Use of the substance or the preparation:
Certified reference material for laboratory use only

1.3 Company/undertaking identification:
Institute for Reference Materials and Measurements
Retieseweg
B-2440 Geel
Tel. : +32 14 57 12 11
Fax : +32 14 58 42 73

1.4 Telephone number for emergency:
+32 70 245 245
Antigifcentrum
p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

2.  Composition/information on ingredients

<table>
<thead>
<tr>
<th>Hazardous ingredients</th>
<th>CAS No.</th>
<th>Conc. in %</th>
<th>Hazard symbol</th>
<th>Risks (R-phrases)</th>
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</thead>
<tbody>
<tr>
<td>chrysene</td>
<td>218-01-9</td>
<td>100</td>
<td>T;N</td>
<td>45-50/53 (1)</td>
</tr>
<tr>
<td></td>
<td>205-923-4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) For R-phrases in full: see heading 16

3.  Hazards identification

- May cause cancer
- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4.  First aid measures

4.1 Eye contact:
- Consult a doctor/medical service if irritation persists
- Rinse immediately with water

4.2 Skin contact:
- Consult a doctor/medical service if irritation persists
- Wash with water and soap
- Wipe off dry product from skin
- Remove clothing before washing

4.3 After inhalation:
- Consult a doctor/medical service if breathing problems develop
- Remove the victim into fresh air
- Unconscious: maintain adequate airway and respiration

4.4 After ingestion:
- Consult a doctor/medical service if you feel unwell
- Immediately give lots of water to drink
- Never give water to an unconscious person
CHRYSENE

- Do not induce vomiting
5. Fire-fighting measures

5.1 Suitable extinguishing media:
- Water spray
- Alcohol foam
- Polymer foam
- ABC powder
- Carbon dioxide

5.2 Unsuitable extinguishing media:
- Solid water jet ineffective as extinguishing medium

5.3 Special exposure hazards:
- Not easily combustible
- Upon combustion CO and CO2 are formed

5.4 Instructions:
- Take account of toxic firefighting water
- Use firefighting water moderately and contain it

5.5 Special protective equipment for firefighters:
- Heat/fire exposure: compressed air/oxygen apparatus
- Dust cloud production: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal protection/precautions: see heading 8.1/8.3/10.3

6.2 Environmental precautions:
- Prevent soil and water pollution
- Substance must not be discharged into the sewer
- Dam up the solid spill

6.3 Methods for cleaning up:
- Stop dust cloud by covering with sand/earth
- Carefully collect the spill/leftovers
- Scoop solid spill into closing containers
- Spill must not return in its original container
- Take collected spill to manufacturer/competent authority
- Clean contaminated surfaces with an excess of water
- Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:
- Observe strict hygiene
- Avoid prolonged and repeated contact with skin
- Avoid raising dust
- Do not discharge the waste into the drain
- Remove contaminated clothing immediately

7.2 Storage:
- Keep container tightly closed. Store only in a limited quantity. Store in a dry area. Store in a dark area.
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

<table>
<thead>
<tr>
<th>Storage temperature</th>
<th>N.D. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity limits</td>
<td>N.D. kg</td>
</tr>
<tr>
<td>Storage life</td>
<td>N.D.</td>
</tr>
<tr>
<td>Materials for packaging</td>
<td>no data available</td>
</tr>
</tbody>
</table>

7.3 Specific uses:
- See information supplied by the manufacturer
8. Exposure controls/Personal protection

8.1 Exposure limit values:

<table>
<thead>
<tr>
<th>Limit Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLV-TWA</td>
<td>not listed</td>
</tr>
<tr>
<td>TLV-STE</td>
<td>not listed</td>
</tr>
<tr>
<td>TLV-Ceiling</td>
<td>not listed</td>
</tr>
<tr>
<td>OES-LTEL</td>
<td>not listed</td>
</tr>
<tr>
<td>OES-STE</td>
<td>not listed</td>
</tr>
<tr>
<td>MEL-LTEL</td>
<td>not listed</td>
</tr>
<tr>
<td>MEL-STE</td>
<td>not listed</td>
</tr>
<tr>
<td>MAK</td>
<td>not listed</td>
</tr>
<tr>
<td>TRK</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-TGG 8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-TGG 15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>MAC-Ceiling</td>
<td>not listed</td>
</tr>
<tr>
<td>VME-8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>VLE-15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>GWBB-8 h</td>
<td>not listed</td>
</tr>
<tr>
<td>GWK-15 min.</td>
<td>not listed</td>
</tr>
<tr>
<td>Momentary value</td>
<td>not listed</td>
</tr>
<tr>
<td>EC</td>
<td>not listed</td>
</tr>
<tr>
<td>EC-STE</td>
<td>not listed</td>
</tr>
</tbody>
</table>

Sampling methods:

- Chrysene (Polynuclear aromatic Hydrocarbons) NIOSH 5515
- Chrysene OSHA 58
- Chrysene (Polynuclear aromatic Hydrocarbons) NIOSH 5506

8.2 Exposure controls:

8.2.1 Occupational exposure controls:
- Measure the concentration in the air regularly
- Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see heading 13

8.3 Personal protection:

8.3.1 respiratory protection:
- Dust production: dust mask with filter type P3
- High dust production: compressed air/oxygen apparatus

8.3.2 hand protection:
- Gloves
  Suitable materials: No data available
  Breakthrough time: N.D.

8.3.3 eye protection:
- Safety glasses
  In case of dust production: protective goggles

8.3.4 skin protection:
- Protective clothing
  In case of dust production: head/neck protection
  Suitable materials: No data available
9. Physical and chemical properties

9.1 General information:
Appearance (at 20°C) : Crystalline solid / Flakes
Odour : Odourless
Colour : White

9.2 Important health, safety and environmental information:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH value</td>
<td>N.D.</td>
</tr>
<tr>
<td>Boiling point/boiling range</td>
<td>448 °C</td>
</tr>
<tr>
<td>Flashpoint</td>
<td>N.D. °C</td>
</tr>
<tr>
<td>Explosion limits</td>
<td>N.D. vol% ( °C)</td>
</tr>
<tr>
<td>Vapour pressure (at 20°C)</td>
<td>N.D. hPa</td>
</tr>
<tr>
<td>Vapour pressure (at 50°C)</td>
<td>N.D. hPa</td>
</tr>
<tr>
<td>Relative density (at 20°C)</td>
<td>1.27</td>
</tr>
<tr>
<td>Water solubility</td>
<td>&lt; 0.001 g/100 ml</td>
</tr>
<tr>
<td>Soluble in</td>
<td>N.D.</td>
</tr>
<tr>
<td>Relative vapour density</td>
<td>N.D.</td>
</tr>
<tr>
<td>Viscosity</td>
<td>N.D. Pa.s</td>
</tr>
<tr>
<td>Partition coefficient n-octanol/water</td>
<td>5.61/5.73</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>N.D.</td>
</tr>
<tr>
<td>ratio to butyl acetate</td>
<td>N.D.</td>
</tr>
<tr>
<td>ratio to ether</td>
<td>N.D.</td>
</tr>
</tbody>
</table>

9.3 Other information:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting point/melting range</td>
<td>256 °C</td>
</tr>
<tr>
<td>Auto-ignition point</td>
<td>N.D. °C</td>
</tr>
<tr>
<td>Saturation concentration</td>
<td>N.D. g/m³</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

10.1 Conditions to avoid/reactivity:
- Stable under normal conditions

10.2 Materials to avoid:
- Keep away from: heat sources, ignition sources, oxidizing agents, acids

10.3 Hazardous decomposition products:
- Upon combustion CO and CO₂ are formed
- Reacts violently with (strong) oxidizers
- Decomposes on exposure to (strong) acids

11. Toxicological information

11.1 Acute toxicity:

<table>
<thead>
<tr>
<th>Test</th>
<th>Rat</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD₅₀ oral rat</td>
<td>N.D. mg/kg</td>
<td></td>
</tr>
<tr>
<td>LD₅₀ dermal rat</td>
<td>N.D. mg/kg</td>
<td></td>
</tr>
<tr>
<td>LD₅₀ dermal rabbit</td>
<td>N.D. mg/kg</td>
<td></td>
</tr>
<tr>
<td>LC₅₀ inhalation rat</td>
<td>N.D. mg/l/4 h</td>
<td></td>
</tr>
<tr>
<td>LC₅₀ inhalation rat</td>
<td>N.D. ppm/4 h</td>
<td></td>
</tr>
</tbody>
</table>
11.2 Chronic toxicity:

EC carc. cat. : 2  
EC muta. cat. : 3  
EC repr. cat. : not listed  
Carcinogenicity (TLV) : A3  
Carcinogenicity (MAC) : K  
Carcinogenicity (VME) : not listed  
Carcinogenicity (GWBB) : not listed  
Carcinogenicity (MAK) : 2  
Mutagenicity (MAK) : not listed  
Teratogenicity (MAK) : -  
IARC classification : 3

11.3 Routes of exposure: ingestion, inhalation, eyes and skin  
Caution! Substance is absorbed through the skin

11.4 Acute effects/symptoms:

AFTER SKIN CONTACT  
- Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic  
- No certainty about human mutagenic properties  
ON CONTINUOUS/REPEATED EXPOSURE/CONTACT:  
- No specific information available  
SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:  
- Feeling of weakness  
- Photoallergy  
- Cracking of the skin  
- Skin rash/inflammation  
- Skin cancer  
- Lung tissue affection/degeneration  
- Enlargement/affection of the liver  
- Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:

- LC50 (24 h) : 0.0007 mg/l (DAPHNIA MAGNA)  
- LC50 (24 h) : >6.7 mg/l (RANA SP.)

12.2 Mobility:

- Volatile organic compounds (VOC): N.D.%  
- Forming sediments in water  
- Adsorbs into the soil  
- Insoluble in water  
For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- biodegradation BOD5 : N.D.  
- water : - Not readily biodegradable in water  
- soil : T ½: >77 days

12.4 Bioaccumulative potential:

- log Pow : 5.61/5.73  
- BCF : 4440 (LAMELLIBRANCHIATA)  
- Highly bioaccumulative
12.5 Other adverse effects:

- **WGK** : 3  
  (Classification based on the R-phrases in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)

- **Effect on the ozone layer** : Not dangerous for the ozone layer  
  (Council Regulation (EC) 3093/94)

- **Greenhouse effect** : no data available

- **Effect on waste water purification** : no data available

### 13. Disposal considerations

#### 13.1 Provisions relating to waste:
  (laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory)

- Waste material code (Flanders): 001, 045, 691

- Waste code (Germany): 59302

- Hazardous waste (91/689/EEC)

#### 13.2 Disposal methods:
- Dissolve or mix with a combustible solvent
- Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber
- Do not discharge into surface water (2000/60/EEC, Council

#### 13.3 Packaging/Container:
  (packaging containing residues of or contaminated by dangerous substances)
14. Transport information

14.1 Classification of the substance in compliance with UN Recommendations

<table>
<thead>
<tr>
<th>UN number</th>
<th>CLASS</th>
<th>SUB RISKS</th>
<th>PACKING</th>
<th>PROPER SHIPPING NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>3077</td>
<td>9</td>
<td>-</td>
<td>III</td>
<td>UN 3077, Environmentally hazardous substance, solid, n.o.s. (chrysene)</td>
</tr>
</tbody>
</table>

14.2 ADR (transport by road)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>PACKING</th>
<th>DANGER LABEL TANKS</th>
<th>DANGER LABEL PACKAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>III</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

14.3 RID (transport by rail)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>PACKING</th>
<th>DANGER LABEL TANKS</th>
<th>DANGER LABEL PACKAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>III</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

14.4 ADNR (transport by inland waterways)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>PACKING</th>
<th>DANGER LABEL TANKS</th>
<th>DANGER LABEL PACKAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>III</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

14.5 IMDG (maritime transport)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SUB RISKS</th>
<th>PACKING</th>
<th>MFAG</th>
<th>EMS</th>
<th>MARINE POLLUTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-</td>
<td>III</td>
<td>-</td>
<td>-</td>
<td>P</td>
</tr>
</tbody>
</table>

14.6 ICAO (air transport)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SUB RISKS</th>
<th>PACKING</th>
<th>PACKING INSTRUCTIONS PASSENGER AIRCRAFT</th>
<th>PACKING INSTRUCTIONS CARGO AIRCRAFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-</td>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14.7 Special precautions in connection with transport

: none

14.8 Limited quantities (LQ)

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:

- each package shall display a diamond-shaped figure with the following inscription:
  - 'UN 3077'
- or, in the case of different goods with different identification numbers within a single package:
  - the letters 'LQ'
15. Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S53 : Avoid exposure - obtain special instructions before use
S45 : In case of accident or if you feel unwell, seek medical advice (show the label where possible)
S60 : This material and/or its container must be disposed of as hazardous waste
S61 : Avoid release to the environment. Refer to special instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. = NOT APPLICABLE
N.D. = NOT DETERMINED
* = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45 : May cause cancer
R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Exposure limits:

TLV : Threshold Limit Value - ACGIH USA 2000
OES : Occupational Exposure Standards - United Kingdom 1999
MEL : Maximum Exposure Limits - United Kingdom 1999
MAK : Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK : Technische Richtkonzentrationen - Germany 2001
MAC : Maximale aanvaarde concentratie - The Netherlands 2002
VME : Valeurs limites de Moyenne d’Exposition - France 1999
VLE : Valeurs limites d’Exposition à court terme - France 1999
GWBB : Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK : Grenswaarde kortstondige blootstelling - Belgium 1998
EC : Indicative occupational exposure limit values - directive 2000/39/EC

Chronic toxicity:

K : List of the carcinogenic substances and processes - The Netherlands 2002
**Section 1 - Chemical Product and Company Identification**

**Chemical Formula:** Cobalt (Co), chromium (Cr) and other alloying elements  
**Product Use:** Cast aerospace parts  
**Other Designations:** 694, 98M2, CoCrNiMoFe, ECY 768, F75, FSX 414, G34, How 1, How 3, How 6, How 12, How 19, How 21, How 25 (L605), How 31 (X40), How 36, How F, How J, Mar-M 302, Mar-M 509, Mar-M 918, Merle 72, MP35N, S 816, PT1377, PT1508, WI 52, X 45 and other Cobalt-Based Alloys

Alcoa Inc.  
201 Isabella Street  
Pittsburgh, PA  15212-5858

**Emergency Information:** USA: Chemtrec:  1-800-424-9300 or 1-703-527-3887  
Alcoa:  1-412-553-4001  
**Website:** For a current MSDS, refer to Alcoa websites: www.alcoa.com or Internally at my.alcoa.com EHS Community

**Section 2 - Hazards Identification**

**EMERGENCY OVERVIEW**  
Explosion/fire hazards may be present when (See Sections 5, 7 and 10 for additional information):  
* Molten metal is in contact with water/moisture.  
* Heavily concentrated dust clouds are dispersed in the air.  
Dust and fume from processing can cause irritation of eyes, skin and upper respiratory tract.

**POTENTIAL HEALTH EFFECTS**  
The following statements summarize the health effects generally expected in cases of overexposures. User specific situations should be assessed by a qualified individual. Additional health information can be found in Section 11.  
The health effects listed below are not likely to occur unless processing or recycling/combustion generate dusts or fumes.  
**Eyes** Dust or fume from processing: Can cause irritation.

**Skin** Dust or fume from processing: Can cause irritation, sensitization and allergic contact dermatitis.  
**Inhalation** Health effects from mechanical processing (e.g., cutting, grinding): Can cause upper respiratory tract irritation. **Chronic overexposures:** Can cause asthma, respiratory sensitization, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males.  
Additional health effects from elevated temperature processing (e.g., welding, melting): **Acute overexposures:** Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever). **Chronic overexposures:** Can cause the accumulation of fluid in the lungs (pulmonary edema) and lung cancer.

**Carcinogenicity and Reproductive Hazard**  
**Product as shipped:** Does not present any cancer or reproductive hazards.  
**Dust and fumes from mechanical processing:** Can present a cancer hazard (nickel, cobalt). Can present a reproductive hazard for males (manganese).  
**Dust and fumes from welding or elevated temperature processing:** Can present a cancer hazard (hexavalent chromium compounds, nickel compounds, welding fumes, cobalt compounds). Can present a reproductive hazard for males (manganese).

**Medical Conditions Aggravated By Exposure to Product, Components or Compounds Formed During Processing**  
**Dust or fume from processing:** Asthma, chronic lung disease, skin rashes and secondary Parkinson's disease.
**Section 3 - Composition / Information on Ingredients**

Complete composition is provided below and may include some components classified as non-hazardous.

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Component</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>7440-48-4</td>
<td>Cobalt</td>
<td>35-65</td>
</tr>
<tr>
<td>7440-47-3</td>
<td>Chromium</td>
<td>15-35</td>
</tr>
<tr>
<td>7440-02-0</td>
<td>Nickel</td>
<td>0-35</td>
</tr>
<tr>
<td>7440-33-7</td>
<td>Tungsten</td>
<td>0-25</td>
</tr>
<tr>
<td>7439-89-6</td>
<td>Iron</td>
<td>0-20</td>
</tr>
<tr>
<td>7439-98-7</td>
<td>Molybdenum</td>
<td>0-15</td>
</tr>
<tr>
<td>7440-25-7</td>
<td>Tantalum</td>
<td>0-10</td>
</tr>
<tr>
<td>7440-62-2</td>
<td>Vanadium</td>
<td>0-5</td>
</tr>
<tr>
<td>7439-96-5</td>
<td>Manganese</td>
<td>0-5</td>
</tr>
<tr>
<td>7429-90-5</td>
<td>Aluminum</td>
<td>0-5</td>
</tr>
<tr>
<td>7440-03-1</td>
<td>Niobium</td>
<td>0-5</td>
</tr>
<tr>
<td>7440-21-3</td>
<td>Silicon</td>
<td>0-5</td>
</tr>
<tr>
<td>7440-44-0</td>
<td>Carbon</td>
<td>0-5</td>
</tr>
</tbody>
</table>

**Component Information**
Additional compounds which may be formed during processing are listed in Section 8.

**Section 4 - First Aid Measures**

**First Aid: Eyes**
Dust or fume from processing: Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician.

**First Aid: Skin**
Dust or fume from processing: Wash skin with soap and water for at least 15 minutes. Consult a physician if irritation persists.

**First Aid: Inhalation**
Dust or fume from processing: Remove to fresh air. If unconscious or severely injured, check for clear airway, breathing and presence of pulse. Perform CPR if there is no pulse or respiration. Consult a physician.

**Section 5 - Fire Fighting Measures**

**Flammable/Combustible Properties**
This product does not present fire or explosion hazards as shipped. Dust and fines may be ignitable.

**Fire/Explosion**
May be a potential hazard under the following conditions:
* Molten metal in contact with water/moisture. Moisture entrapped by molten metal can be explosive. * Dust or fines dispersed in the air can be explosive. Heavily concentrated dusts in air can be explosive if subjected to a strong ignition source.

**Extinguishing Media**
Use a Class D agent, fluxing salts, graphite or dry sand on dust or fine fires. Otherwise, use fire fighting methods and materials that are appropriate for surrounding fire.

**Unsuitable Extinguishing Media**
DO NOT USE:
* Water around molten metal.
These agents will react with the burning material.

**Fire Fighting Equipment/Instructions**
Fire fighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.
**Section 6 - Accidental Release Measures**


**Section 7 - Handling and Storage**

Handling/Storage
Avoid generating dust. Avoid contact with sharp edges or heated metal. Product should be kept dry. Do not eat, drink, apply cosmetics, or smoke when handling or using.

Requirements for Remelting of Scrap Material and/or Ingot
Molten metal and water can be an explosive combination. The risk is greatest when there is sufficient molten metal to entrap or seal off the water. Water and other forms of contamination on or contained in scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

During melting operations, the following minimum guidelines should be observed:
* Inspect all materials prior to furnace charging and completely remove surface contamination such as water, ice, snow, deposits of grease and oil or other surface contamination resulting from weather exposure, shipment, or storage.
* Store materials in dry, heated areas with any cracks or cavities pointed downwards.
* Preheat and dry large or heavy items such as ingot adequately before charging into a furnace containing molten metal. This is typically done by use of a drying oven or homogenizing furnace. The drying cycle should bring the internal metal temperature of the coldest item of the batch to 400°F and then hold at that temperature for 6 hours.

**Section 8 - Exposure Controls / Personal Protection**

Engineering Controls
If dust or fumes are generated through processing: Use with adequate ventilation to meet the limits listed in Section 8, Exposure Guidelines.

Personal Protective Equipment

Respiratory Protection
If dust or fumes are generated through processing: Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 8, Exposure Guidelines. Suggested respiratory protection: N95

Eye Protection Wear safety glasses/goggles to avoid eye injury.

Skin Protection Wear appropriate gloves to avoid any skin injury.

General
Personnel who handle and work with molten metal should utilize primary protective clothing like polycarbonate face shields, fire resistant tapper's jackets, neck shades (snooods), leggings, spats and similar equipment to prevent burn injuries. In addition to primary protection, secondary or day-to-day work clothing that is fire resistant and sheds metal splash is recommended for use with molten metal. Synthetic materials should never be worn even as secondary clothing (undergarments).

Exposure Guidelines

A: General Product Information
No Occupational Exposure Limit has been developed specifically for this product.
Alcoa recommends an Occupational Exposure Limit for Cobalt of 0.02 mg/m³ TWA.
Alcoa recommends an Occupational Exposure Limit for Chromium (VI) Compounds [both soluble and insoluble forms] of 0.25 ug/m³ TWA as chromium.
Alcoa recommends an Occupational Exposure Limit for Nickel Compounds of 0.1 mg/m³ TWA.
Alcoa recommends Occupational Exposure Limits for Manganese of 0.05 mg/m³ TWA (total particulate) and 0.02 mg/m³ TWA (respirable fraction).
B: Component Exposure Limits

Cobalt (7440-48-4)
- ACGIH 0.02 mg/m³ TWA
- OSHA 0.1 mg/m³ TWA (dust and fume)

Chromium (7440-47-3)
- ACGIH 0.5 mg/m³ TWA
- OSHA 1 mg/m³ TWA

Nickel (7440-02-0)
- ACGIH 1.5 mg/m³ TWA (inhalable fraction)
- OSHA 1 mg/m³ TWA

Tungsten (7440-33-7)
- ACGIH 5 mg/m³ TWA
- ACGIH 10 mg/m³ STEL

Molybdenum (7439-98-7)
- ACGIH 10 mg/m³ TWA (inhalable fraction); 3 mg/m³ TWA (respirable fraction)
- OSHA 15 mg/m³ TWA (total dust)

Tantalum (7440-25-7)
- ACGIH 5 mg/m³ TWA (dust)
- OSHA 5 mg/m³ TWA

Vanadium (7440-62-2)
- OSHA 0.5 mg/m³ Ceiling (respirable dust, as V2O5); 0.1 mg/m³ Ceiling (fume, as V2O5)

Manganese (7439-96-5)
- ACGIH 0.2 mg/m³ TWA
- OSHA 5 mg/m³ Ceiling (fume)

Aluminum (7429-90-5)
- ACGIH 10 mg/m³ TWA (metal dust)
- OSHA 15 mg/m³ TWA (total dust); 5 mg/m³ TWA (respirable fraction)

Silicon (7440-21-3)
- OSHA 15 mg/m³ TWA (total dust); 5 mg/m³ TWA (respirable fraction)

C: Exposure Limits for Additional Compounds Which May Be Formed During Processing

Chromium (II) compounds (Not Available)
- OSHA 0.5 mg/m³ TWA (as Cr)

Chromium (III) Compounds (Not Available)
- ACGIH 0.5 mg/m³ TWA (as Cr)
- OSHA 0.5 mg/m³ TWA (as Cr)

Chromium (VI) compounds- water soluble (Not Available)
- ACGIH 0.05 mg/m³ TWA (as Cr)

Chromium (VI) compounds (certain water insoluble forms) (Not Available)
- ACGIH 0.01 mg/m³ TWA (as Cr)

Chromium (VI) (18540-29-9)
- OSHA 2.5 µg/m³ Action Level; 5 µg/m³ TWA (Cancer hazard - See 29 CFR 1910.1026)

Nickel insoluble compounds (Not Available)
- ACGIH 0.2 mg/m³ TWA (inhalable fraction, as Ni)
- OSHA 1 mg/m³ TWA (as Ni)

Tungsten, insoluble compounds (Not Available)
- ACGIH 5 mg/m³ TWA (as W)
- ACGIH 10 mg/m³ STEL (as W)

Iron oxide (1309-37-1)
- ACGIH 5 mg/m³ TWA (respirable fraction)
- OSHA 10 mg/m³ TWA
Material Safety Data Sheet

Molybdenum insoluble compounds (Not Available)
  ACGIH  10 mg/m³ TWA (inhalable fraction, as Mo); 3 mg/m³ TWA (respirable fraction, as Mo)
  OSHA   15 mg/m³ TWA (total dust)

Tantalum oxide (1314-61-0)
  ACGIH  5 mg/m³ TWA (dust, as Ta)
  OSHA   5 mg/m³ TWA (dust)

Vanadium pentoxide (1314-62-1)
  ACGIH  0.05 mg/m³ TWA (dust or fume, respirable fraction)
  OSHA   0.5 mg/m³ Ceiling (respirable dust, as V₂O₅); 0.1 mg/m³ Ceiling (fume, as V₂O₅)

Manganese compounds, inorganic (Not Available)
  ACGIH  0.2 mg/m³ TWA (as Mn)
  OSHA   5 mg/m³ Ceiling (as Mn) (related to Manganese compounds)

Aluminum oxide (1344-28-1)
  ACGIH  10 mg/m³ TWA (particulate matter containing no asbestos and <1% crystalline silica)
  OSHA   15 mg/m³ TWA (total dust); 5 mg/m³ TWA (respirable fraction)

*** Section 9 - Physical & Chemical Properties ***

<table>
<thead>
<tr>
<th>Physical State:</th>
<th>Solid</th>
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</thead>
<tbody>
<tr>
<td>Boiling Point:</td>
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</tr>
<tr>
<td>Vapor Pressure:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Solubility in Water:</td>
<td>Not soluble</td>
</tr>
<tr>
<td>Density:</td>
<td>550 lb/ft³ (8.8 g/cm³)</td>
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<tr>
<td>Odor:</td>
<td>Odorless</td>
</tr>
<tr>
<td>Octanol-Water Coefficient:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

| Appearance: | Metallic appearance |
| Melting Point: | 2719°F (1493°C) Cobalt |
| Vapor Density: | Not applicable |
| Specific Gravity: | See Density |
| pH Level: | Not applicable |
| Odor Threshold: | Not applicable |

*** Section 10 - Chemical Stability & Reactivity Information ***

Stability Stable under normal conditions of use, storage, and transportation.
Conditions to Avoid
  In powder form, can react with strong oxidizers such as concentrated nitric acid. Molten metal can react violently/explosively with water or moisture, particularly when the water is entrapped.

*** Section 11 - Toxicological Information ***

Health Effects Associated with Individual Ingredients

Cobalt Can cause irritation of eyes, skin and respiratory tract. Skin contact: Can cause allergic reactions. Acute and chronic overexposures: Can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis) and damage to the heart muscle (cardiomyopathy). **Cobalt and certain cobalt compounds** IARC/NTP: Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Chromium dust and mist Can cause irritation of eyes, skin and respiratory tract. **Chromium and trivalent chromium** IARC/NTP: Listed as "unclassifiable as to carcinogenicity in humans" by IARC (Group 3).

Nickel dust and fumes Can cause irritation of eyes, skin and respiratory tract. **Eye contact**: Can cause inflammation of the eyes and eyelids (conjunctivitis). Skin contact: Can cause sensitization and allergic contact dermatitis. Chronic overexposures: Can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma and scarring of the lungs (pulmonary fibrosis). **Nickel alloys** IARC/NTP: Reviewed but not recommended for listing by the NTP. Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Tungsten dust Can cause irritation of eyes, skin and upper respiratory tract.
Molybdenum dust and fumes  Can cause irritation of mucous membranes, skin and respiratory tract.  **Acute overexposures:** Can cause headache, backache and sore joints.  **Chronic overexposures:** Can cause deformities of the joints, blood disorders, kidney damage, lung damage and liver damage.

Tantalum and tantalum oxide  Can cause mechanical irritation of eyes, skin and upper respiratory tract.  Generally of low toxicity.

Manganese dust or fumes  **Chronic overexposures:** Can cause inflammation of the lung tissue, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson’s disease and reproductive harm in males.

Aluminum dust, fines and fumes  Low health risk by inhalation.  Generally considered to be biologically inert.

Niobium dust and fumes  **Acute overexposures:** Generally of low toxicity.  **Chronic overexposures:** Can cause lung damage.

Silicon, inert dusts  **Chronic overexposures:** Can cause chronic bronchitis and narrowing of the airways.

Health Effects Associated with Individual Compounds Formed During Processing
(The following could be expected if welded, remelted or otherwise processed at elevated temperatures.)

Hexavalent chromium (Chrome VI)  Can cause irritation of eyes, skin and respiratory tract.  **Skin contact:** Can cause irritant dermatitis, allergic reactions and skin ulcers.  **Chronic overexposures:** Can cause perforation of the nasal septum, respiratory sensitization, asthma, the accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer and cancer of the gastrointestinal tract.  **IARC/NTP:** Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Nickel compounds  Associated with lung cancer, cancer of the vocal cords and nasal cancer.  **IARC/NTP:** Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Iron oxide  **Chronic overexposures:** Can cause benign lung disease (siderosis).  **Ingestion:** Can cause irritation of gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis) and liver damage.

Molybdenum trioxide  Can cause irritation of eyes, mucous membranes and upper respiratory tract.  **Chronic overexposures:** Can cause reduction in the number of red blood cells (anemia), predisposition to gout, thyroid function changes, liver damage and lung damage.  **Additional information:** Studies with experimental animals by inhalation have found lung cancer.

Vanadium pentoxide  Can cause irritation of eyes, skin and respiratory tract.  **Skin contact (prolonged or repeated):** Can cause sensitization and dermatitis.  **Acute overexposures:** Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days.  **Chronic overexposures:** Can cause kidney damage, blindness, asthma and emphysema.  **IARC/NTP:** Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Manganese oxide fumes  Can cause irritation of eyes, skin and respiratory tract.  **Skin contact (prolonged or repeated):** Can cause sensitization and dermatitis.  **Acute overexposures:** Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days.  **Chronic overexposures:** Can cause kidney damage, blindness, asthma and emphysema.  **IARC/NTP:** Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Alumina (aluminum oxide)  Low health risk by inhalation.  Generally considered to be biologically inert.

Silica, amorphous  **Acute overexposures:** Can cause dryness of eyes, nose and upper respiratory tract.

**Acute Toxicity of Ingredients/Formed Compounds**

**A:** General Product Information  No information available for product.

**B:** Component Analysis - LD50/LC50

**Cobalt (7440-48-4)**  Inhalation LC50 Rat: >10 mg/L/1H; Oral LD50 Rat: 6170 mg/kg
Material Safety Data Sheet

Product Name: COBALT-BASED ALLOYS

Nickel (7440-02-0) Oral LD50 Rat: >9000 mg/kg
Iron (7439-89-6) Oral LD50 Rat: 984 mg/kg
Manganese (7439-96-5) Oral LD50 Rat: 9 g/kg
Silicon (7440-21-3) Oral LD50 Rat: 3160 mg/kg
Carbon (7440-44-0) Oral LD50 Rat: >10000 mg/kg

C: Formed Compound Toxicity - LD50s/LC50s
Iron oxide (1309-37-1) Oral LD50 Rat: >10000 mg/kg
Tantalum oxide (1314-61-0) Oral LD50 Rat: 8 g/kg
Vanadium pentoxide (1314-62-1)
Inhalation LC50 Rat: 2.21 mg/L/4H; Oral LD50 Rat: 10 mg/kg; Dermal LD50 Rat: >2500 mg/kg
Aluminum oxide (1344-28-1) Oral LD50 Rat: >5000 mg/kg
Silicon dioxide (amorphous) (69012-64-2)
Oral LD50 Rat: >5000 mg/kg; Inhalation LC50 Rat: >2.2 mg/L/1H; Dermal LD50 Rabbit: >2000 mg/kg (related to Silica, amorphous)

Carcinogenicity of Ingredients
A: Ingredient Carcinogenicity - IARC/NTP

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>IARC 1</th>
<th>IARC 2A</th>
<th>IARC 2B</th>
<th>IARC 3</th>
<th>IARC 4</th>
<th>NTP K</th>
<th>NTP RA</th>
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<tr>
<td>Chromium</td>
<td>7440-47-3</td>
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<td>No</td>
<td>No</td>
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<td>No</td>
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<td>Nickel</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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</table>

B: Ingredient Carcinogenicity - ACGIH
Cobalt (7440-48-4)
ACGIH A3 - Confirmed animal carcinogen with unknown relevance to humans
Chromium (7440-47-3)
ACGIH A4 - Not Classifiable as a Human Carcinogen
Nickel (7440-02-0)
ACGIH A5 - Not Suspected as a Human Carcinogen

C: Ingredient References
Cobalt (7440-48-4)
IARC Monograph 86 [2006] (without tungsten carbide), Monograph 52 [1991]
Chromium (7440-47-3)
IARC Monograph 49 [1990] (listed under Chromium and Chromium compounds), Supplement 7 [1987]
Nickel (7440-02-0)
IARC Monograph 49 [1990], Supplement 7 [1987]

Carcinogenicity of Compounds Formed During Processing
A: Formed Compound Carcinogenicity - IARC/NTP

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>IARC 1</th>
<th>IARC 2A</th>
<th>IARC 2B</th>
<th>IARC 3</th>
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<th>NTP K</th>
<th>NTP RA</th>
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<td>Chromium (III) Compounds</td>
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<td>No</td>
<td>No</td>
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<tr>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Nickel compounds</td>
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<td>No</td>
<td>No</td>
<td>No</td>
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<td>Iron oxide</td>
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<td>No</td>
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<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
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<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Silicon dioxide (amorphous) (related to Silica, amorphous)</td>
<td>69012-64-2</td>
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<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</tr>
</tbody>
</table>
B: Formed Compound Carcinogenicity - ACGIH
Chromium (III) Compounds (Not Available)
  ACGIH  A4 - Not Classifiable as a Human Carcinogen
Chromium (VI) compounds- water soluble (Not Available)
  ACGIH  A1 - Confirmed Human Carcinogen
Chromium (VI) compounds (certain water insoluble forms) (Not Available)
  ACGIH  A1 - Confirmed Human Carcinogen
Nickel insoluble compounds (Not Available)
  ACGIH  A1 - Confirmed Human Carcinogen
Iron oxide (1309-37-1)
  ACGIH  A4 - Not Classifiable as a Human Carcinogen
Vanadium pentoxide (1314-62-1)
  ACGIH  A4 - Not Classifiable as a Human Carcinogen (dust and fume)
Aluminum oxide (1344-28-1)
  ACGIH  A4 - Not Classifiable as a Human Carcinogen

C: Formed Compound References
Chromium (III) Compounds (Not Available)
  IARC  Monograph 49 [1990] (listed under Chromium and Chromium compounds),
  Supplement 7 [1987]
Chromium (VI) compounds (certain water insoluble forms) (Not Available)
  IARC  Monograph 49 [1990] (evaluated as a group)
Chromium (VI) (18540-29-9)
  IARC  Monograph 49 [1990] (evaluated as a group)
Nickel compounds (Not Available)
  IARC  Monograph 49 [1990] (evaluated as a group)
Iron oxide (1309-37-1)
  IARC  Supplement 7 [1987], Monograph 1 [1972]
Vanadium pentoxide (1314-62-1)
  IARC  Monograph 86 [2006]
Silicon dioxide (amorphous) (69012-64-2)
  IARC  Monograph 68 [1997], Supplement 7 [1987] (related to Silica, amorphous)

Descriptions of IARC and NTP Classifications
  IARC 1:  The agent is carcinogenic to humans. There is sufficient evidence that a causal relationship existed between exposure to the agent and human cancer.
  IARC 2A: The agent is probably carcinogenic to humans. Generally includes agents for which there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals.
  IARC 2B: The agent is possibly carcinogenic to humans. Generally includes agents for which there is limited evidence in humans and less than sufficient evidence in experimental animals.
  IARC 3:  The agent is not classifiable as to its carcinogenicity to humans. Generally includes agents for which there is inadequate evidence in humans and inadequate or limited evidence in experimental animals.
  IARC 4:  The agent is probably not carcinogenic to humans. Generally includes agents for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals.
  NTP K:  Known to be a human carcinogen.
  NTP RA:  Reasonably anticipated to be a human carcinogen.

*** Section 12 - Ecological Information ***

Ecotoxicity
A: General Product Information  No information available for product.
B: Component Analysis - Ecotoxicity - Aquatic Toxicity
  Cobalt (7440-48-4)  96 Hr LC50 Brachydanio rerio: >100 mg/L (static)
Nickel (7440-02-0)
96 Hr LC50 Oncorhynchus mykiss: 31.7 mg/L (adult); 96 Hr LC50 Pimephales promelas: 3.1 mg/L; 96 Hr LC50 Brachydanio rerio: >100 mg/L
72 Hr EC50 freshwater algae (4 species): 0.1 mg/L; 72 Hr EC50 Selenastrum capricornutum: 0.18 mg/L
96 Hr EC50 water flea: 510 µg/L
Iron (7439-89-6) 96 Hr LC50 Morone saxatilis: 13.6 mg/L [static]

Environmental Fate  No information available for product.

*** Section 13 - Disposal Considerations ***

Disposal Instructions  Reuse or recycle material whenever possible.

US EPA Waste Number & Descriptions
A: General Product Information
   If reuse or recycle is not possible, then characterize in accordance with applicable regulations (40 CFR 261 or state equivalent in the U.S.) prior to disposal. TCLP testing is recommended for chromium.

B: Component Waste Numbers
   RCRA waste codes other than described under Section A may apply depending on use of product. Refer to 40 CFR 261 or state equivalent in the U.S.

*** Section 14 - Transportation Information ***

Special Transportation

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<th>PSN #2</th>
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<td>UN NA Number:</td>
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<td>Proper Shipping Name:</td>
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<tr>
<td>Other - Marine Pollutant:</td>
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</tbody>
</table>

Notes:
(1) When "Not regulated," enter the proper freight classification, "MSDS Number," and "Product Name" on the shipping paperwork.

Canadian Controlled Products Regulation PIN: Not regulated

*** Section 15 - Regulatory Information ***

US Federal Regulations
A: General Product Information
   In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.

B: Component Analysis
   This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Cobalt (7440-48-4)
   SARA 313: 0.1 % de minimis concentration

Chromium (7440-47-3)
   SARA 313: 1.0 % de minimis concentration
   CERCLA: 5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 2270 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)
Nickel (7440-02-0)
SARA 313: 0.1% de minimis concentration
CERCLA: 100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

Vanadium (7440-62-2)
SARA 313: 1.0% de minimis concentration (except when contained in an alloy)

Manganese (7439-96-5)
SARA 313: 1.0% de minimis concentration

Aluminum (7429-90-5)
SARA 313: 1.0% de minimis concentration (dust or fume only)

SARA 311/312 Physical and Health Hazard Categories:
Immediate (acute) Health Hazard: Yes, if particulates/fumes generated during processing
Delayed (chronic) Health Hazard: Yes, if particulates/fumes generated during processing
Fire Hazard: No
Sudden Release of Pressure: No
Reactive: No

State Regulations
A: General Product Information
PENNSYLVANIA "Special Hazardous Substance": Chromium, Nickel
Chemical(s) known to the State of California to cause cancer: Chromium (hexavalent compounds), Cobalt metal powder, Nickel (metallic) and nickel compounds

B: Component Analysis - State
The following components appear on one or more of the following state hazardous substances lists:

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<thead>
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<th>Component</th>
<th>CAS #</th>
<th>CA</th>
<th>FL</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
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<tbody>
<tr>
<td>Cobalt</td>
<td>7440-48-4</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Chromium</td>
<td>7440-47-3</td>
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<td>Nickel</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Tungsten</td>
<td>7440-33-7</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Iron</td>
<td>7439-89-6</td>
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<td>Silicon</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):
WARNING! This product contains a chemical known to the state of California to cause cancer.

Other Regulations
A: General Product Information
Material meets the criteria for inclusion in WHMIS Class D2A.

B: Component Analysis - WHMIS IDL
The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>Minimum Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt</td>
<td>7440-48-4</td>
<td>0.1%</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>0.1%</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>0.1%</td>
</tr>
<tr>
<td>Tungsten</td>
<td>7440-33-7</td>
<td>1%</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>1%</td>
</tr>
<tr>
<td>Tantalum</td>
<td>7440-25-7</td>
<td>1%</td>
</tr>
<tr>
<td>Vanadium</td>
<td>7440-62-2</td>
<td>1%</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>1%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>7429-90-5</td>
<td>1%</td>
</tr>
</tbody>
</table>
### C: Component Analysis - Inventory

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>TSCA</th>
<th>DSL</th>
<th>EINECS</th>
<th>AUST.</th>
<th>MITI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt</td>
<td>7440-48-4</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Tungsten</td>
<td>7440-33-7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Tantalum</td>
<td>7440-25-7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Vanadium</td>
<td>7440-62-2</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Aluminum</td>
<td>7429-90-5</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Niobium</td>
<td>7440-03-1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Silicon</td>
<td>7440-21-3</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Carbon</td>
<td>7440-44-0</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

**Inventory information**

**MITI Inventory:** Pure metals are not specifically listed by CAS or MITI number on the MITI Inventory. However, the class of compounds for each of these metals is listed.

### *** Section 16 - Other Information ***

**MSDS History**
- Original: June 18, 2001
- Supersedes: October 11, 2004
- Revised: April 22, 2008

**MSDS Status**
- 04/22/2008: Reviewed on a periodic basis in accordance with Alcoa policy. Changes in Sections 1, 2, 3, 4, 5, 8, 11, 12, 13, 14 & 15.
- 10/11/2004: Combined with Alcoa MSDS #'s 1148 and 1149. Changes in Sections 1, 2, 3, 8 and 15. Covers some products formerly on Howmet MSDSs 201, 202, 203, 204, 205, 206 and 504.
- 06/18/2001: New MSDS; covers some products formerly on Howmet MSDS 201.

**Prepared By**
- Hazardous Materials Control Committee
- Preparer: Stephanie Williams, 412-553-1479/Jon N. Peace, 412-553-2293

**MSDS System Number**
- 159242

**Other Information**
- * Guide to Occupational Exposure Values-2007, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH).
**Material Safety Data Sheet**

**Product Name:** COBALT-BASED ALLOYS  
**ID:** 1147

---

**Key-Legend:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH</td>
<td>American Conference of Governmental Industrial Hygienists</td>
</tr>
<tr>
<td>AICS</td>
<td>Australian Inventory of Chemical Substances</td>
</tr>
<tr>
<td>CAS</td>
<td>Chemical Abstract Service</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability Act</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CPR</td>
<td>Cardio-pulmonary Resuscitation</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>DSL</td>
<td>Domestic Substances List (Canada)</td>
</tr>
<tr>
<td>EC</td>
<td>Effective Concentration</td>
</tr>
<tr>
<td>ED</td>
<td>Effective Dose</td>
</tr>
<tr>
<td>EINECS</td>
<td>European Inventory of Existing Commercial Chemical Substances</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Act</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency for Research on Cancer</td>
</tr>
<tr>
<td>LC50</td>
<td>Lethal concentration (50 percent kill)</td>
</tr>
<tr>
<td>LCLo</td>
<td>Lowest published lethal concentration</td>
</tr>
<tr>
<td>LD50</td>
<td>Lethal dose (50 percent kill)</td>
</tr>
<tr>
<td>LDLo</td>
<td>Lowest published lethal dose</td>
</tr>
<tr>
<td>LFL</td>
<td>Lower Flammable Limit</td>
</tr>
<tr>
<td>MITI</td>
<td>Ministry of International Trade &amp; Industry</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute for Occupational Safety and Health</td>
</tr>
<tr>
<td>NORM</td>
<td>Naturally Occurring Radioactive Materials</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program</td>
</tr>
<tr>
<td>OEL</td>
<td>Occupational Exposure Limit</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PEL</td>
<td>Permissible Exposure Limit</td>
</tr>
<tr>
<td>PIN</td>
<td>Product Identification Number</td>
</tr>
<tr>
<td>PSN</td>
<td>Proper Shipping Name</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>SARA</td>
<td>Superfund Amendments and Reauthorization Act</td>
</tr>
<tr>
<td>STEL</td>
<td>Short Term Exposure Limit</td>
</tr>
<tr>
<td>TCLP</td>
<td>Toxic Chemicals Leachate Program</td>
</tr>
<tr>
<td>TDG</td>
<td>Transportation of Dangerous Goods</td>
</tr>
<tr>
<td>TLV</td>
<td>Threshold Limit Value</td>
</tr>
<tr>
<td>TSCA</td>
<td>Toxic Substance Control Act</td>
</tr>
<tr>
<td>TWA</td>
<td>Time Weighted Average</td>
</tr>
<tr>
<td>UFL</td>
<td>Upper Flammable Limit</td>
</tr>
<tr>
<td>WHMIS</td>
<td>Workplace Hazardous Materials Information System</td>
</tr>
</tbody>
</table>

---

INFORMATION HEREIN IS GIVEN IN GOOD FAITH AS AUTHORITATIVE AND VALID; HOWEVER, NO WARRANTY, EXPRESS OR IMPLIED, CAN BE MADE.

---

This is the end of MSDS # 1147
COBALT-BASED ALLOYS

WARNING

Physical Hazards: Non-combustible as supplied. Dust and fines from processing may be ignitable. Explosion/fire hazards may be present when (1) molten metal is in contact with water or moisture or (2) heavily concentrated dust clouds are dispersed in air.

Health Hazards: Health effects generally expected in cases of overexposures:

EYES: Dust or fume from processing: Can cause irritation.

SKIN: Dust or fume from processing: Can cause irritation, sensitization and allergic contact dermatitis.

INHALATION: Health effects from mechanical processing (e.g., cutting, grinding): Can cause upper respiratory tract irritation. **Chronic overexposures:** Can cause asthma, respiratory sensitization, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males. **Additional health effects from elevated temperature processing (e.g., welding, melting):** **Acute overexposures:** Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever). **Chronic overexposures:** Can cause the accumulation of fluid in the lungs (pulmonary edema) and lung cancer.

**WARNING:** Cobalt metal powder, Chromium (hexavalent compounds) and nickel (metallic) and nickel compounds are chemicals known to the State of California to cause cancer (Proposition 65).

Precautions: Avoid generating dust. Use with adequate ventilation. Keep material dry. Use appropriate personal protective equipment (safety glasses/gloves) to avoid injury. Use appropriate NIOSH approved respiratory protection (N95) if concentrations exceed the permissible limits.

First Aid (dust or fume from processing): EYES: Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician. SKIN: Wash skin with soap and water for at least 15 minutes. Consult a physician if irritation persists. INHALATION: Remove to fresh air. If unconscious or severely injured, check for clear airway, breathing and presence of pulse. Perform CPR if there is no pulse or respiration. Consult a physician.

In case of fire: Use a Class D agent, fluxing salts, graphite or dry sand on dust or fine fires. Otherwise, use fire fighting methods and materials that are appropriate for surrounding fire. Do NOT use water around molten metal. This will react with the burning material.

Read Alcoa Material Safety Data Sheet No. 1147 for more information about use and disposal.

Emergency Phone: (412) 553-4001.

INGREDIENTS: CAS No: INGREDIENTS: CAS No:
Cobalt (7440-48-4) Vanadium (7440-62-2)
Chromium (7440-47-3) Manganese (7439-96-5)
Nickel (7440-02-0) Aluminum (7429-90-5)
Tungsten (7440-33-7) Niobium (7440-03-1)
Iron (7439-89-6) Silicon (7440-21-3)
Molybdenum (7439-98-7) Carbon (7440-44-0)
Tantalum (7440-25-7)

Alcoa Inc.
201 Isabella Street, Pittsburgh, PA 15212-5858 USA

4/08 1147
ERROR: undefined
OFFENDING COMMAND: get

STACK:

/quit
/-dictionary-
/-mark-
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Cumene

Product Number: 36698
Brand: Sigma-Aldrich
Index-No.: 601-024-00-X

CAS-No.: 98-82-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

**GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Flammable liquids (Category 3), H226
Carcinogenicity (Category 2), H351
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

**Pictogram**

**Signal word**: Danger

**Hazard statement(s)**
H226: Flammable liquid and vapour.
H304: May be fatal if swallowed and enters airways.
H335: May cause respiratory irritation.
H351: Suspected of causing cancer.
H411: Toxic to aquatic life with long lasting effects.

**Precautionary statement(s)**
P201: Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P331 Do NOT induce vomiting.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms : Isopropylbenzene
Formula : C_9H_{12}
Molecular weight : 120.19 g/mol
CAS-No. : 98-82-8
EC-No. : 202-704-5
Index-No. : 601-024-00-X

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>Flam. Liq. 3; Carc. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 2; Aquatic Chronic 2; H226, H304, H335, H351, H411</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.
If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES
5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES
6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE
7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated
8. EXPOSURE CONTROLS/PERSOAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>TWA</td>
<td>50.000000 ppm</td>
<td>USA, ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks: Central Nervous System impairment
Upper Respiratory Tract irritation
Eye irritation
Skin irritation

<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50.000000 ppm</td>
<td>USA, NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>245.000000 mg/m3</td>
<td>USA, Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

Potential for dermal absorption

<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50.000000 ppm</td>
<td>USA, ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td>245.000000 mg/m3</td>
<td>USA, NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

Skin designation
The value in mg/m3 is approximate.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 30 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals. Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**9.1 Information on basic physical and chemical properties**

a) **Appearance** Form: liquid, clear
   Colour: colourless

b) **Odour** No data available

c) **Odour Threshold** No data available

d) **pH** No data available

e) **Melting point/freezing point** Melting point/range: -96 °C (-141 °F) - lit.

f) **Initial boiling point and boiling range** 152 - 154 °C (306 - 309 °F) - lit.

g) **Flash point** 31.0 °C (87.8 °F) - closed cup

h) **Evaporation rate** No data available

i) **Flammability (solid, gas)** No data available

j) **Upper/lower flammability or explosive limits**
   - Upper explosion limit: 6.5 % (V)
   - Lower explosion limit: 0.9 % (V)

k) **Vapour pressure** 10.7 hPa (8.0 mmHg) at 20.0 °C (68.0 °F)

l) **Vapour density** No data available

m) **Relative density** 0.864 g/cm³ at 25 °C (77 °F)

n) **Water solubility** 0.06 g/l at 25 °C (77 °F) - slightly soluble

o) **Partition coefficient: n-octanol/water** log Pow: 3.55 at 23 °C (73 °F)

p) **Auto-ignition temperature** 425.0 °C (797.0 °F)

q) **Decomposition temperature** No data available

r) **Viscosity** No data available

s) **Explosive properties** No data available

t) **Oxidizing properties** No data available

**9.2 Other safety information**

- **Surface tension** 27.69 mN/m at 25 °C (77 °F)

### 10. STABILITY AND REACTIVITY

**10.1 Reactivity**
No data available

**10.2 Chemical stability**
Stable under recommended storage conditions.
Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.
10.3 **Possibility of hazardous reactions**
Vapours may form explosive mixture with air.

10.4 **Conditions to avoid**
Heat, flames and sparks.

10.5 **Incompatible materials**
Strong oxidizing agents

10.6 **Hazardous decomposition products**
Other decomposition products - No data available
In the event of fire: see section 5

---

11. **TOXICOLOGICAL INFORMATION**

11.1 **Information on toxicological effects**

**Acute toxicity**
- LD50 Oral - Rat - male - 2,260 mg/kg
- Inhalation: No data available
- Dermal: No data available
- NOAEL Feed - Rat - male - > 535.8 mg/kg

**Skin corrosion/irritation**
- Skin - Rabbit
  - Result: No skin irritation
  - (OECD Test Guideline 404)

**Serious eye damage/eye irritation**
- Eyes - Rabbit
  - Result: No eye irritation
  - (OECD Test Guideline 405)

**Respiratory or skin sensitisation**
- Guinea pig
  - Result: Did not cause sensitisation on laboratory animals.
  - (OECD Test Guideline 406)

**Germ cell mutagenicity**
- in vitro assay
  - S. typhimurium
  - Result: negative
  - Mutagenicity (micronucleus test)
  - Mouse - male and female
  - Result: negative

**Carcinogenicity**
- IARC: 2B - Group 2B: Possibly carcinogenic to humans (Cumene)
- NTP: Reasonably anticipated to be a human carcinogen (Cumene)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
- No data available
  - No data available

**Specific target organ toxicity - single exposure**
- May cause respiratory irritation.

**Specific target organ toxicity - repeated exposure**
- No data available
Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: GR8575000

narcosis, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Damage to the lungs., Liver injury may occur., Kidney injury may occur.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - Oncorhynchus mykiss (rainbow trout) - 4.8 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia (water flea) - 2.14 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 2.60 mg/l - 72 h

12.2 Persistence and degradability
Biodegradability Result: - According to the results of tests of biodegradability this product is not readily biodegradable.
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1918 Class: 3 Packing group: III
Proper shipping name: Isopropylbenzene
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1918 Class: 3 Packing group: III EMS-No: F-E, S-E
Proper shipping name: ISOPROPYLBENZENE Marine pollutant:yes
IATA
UN number: 1918  
Class: 3  
Packing group: III  
Proper shipping name: Isopropylbenzene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>2010-06-11</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- Aquatic Acute: Acute aquatic toxicity
- Aquatic Chronic: Chronic aquatic toxicity
- Asp. Tox.: Aspiration hazard
- Carc.: Carcinogenicity
- Flam. Liq.: Flammable liquids
- H226: Flammable liquid and vapour.
- H304: May be fatal if swallowed and enters airways.
- H335: May cause respiratory irritation.
- H351: Suspected of causing cancer.
- H401: Toxic to aquatic life.
- H411: Toxic to aquatic life with long lasting effects.

HMIS Rating

- Health hazard: 2
- Chronic Health Hazard: *
- Flammability: 3
- Physical Hazard: 0

NFPA Rating

- Health hazard: 2
- Fire Hazard: 3
- Reactivity Hazard: 0
Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.8  Revision Date: 12/01/2015  Print Date: 05/13/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: Cyclohexane
Product Number: 320633
Brand: Aldrich
Index-No.: 601-017-00-1
CAS-No.: 110-82-7

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Manufacture of substances
Uses advised against:

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H225: Highly flammable liquid and vapour.
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H336: May cause drowsiness or dizziness.
H400: Very toxic to aquatic life.

Precautionary statement(s)
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/equipment.

Take precautionary measures against static discharge.

Avoid breathing dust/fume/gas/mist/vapours/spray.

Wash skin thoroughly after handling.

Use only outdoors or in a well-ventilated area.

Avoid release to the environment.

Wear protective gloves/eye protection/face protection.

IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.

Do NOT induce vomiting.

If skin irritation occurs: Get medical advice/attention.

Take off contaminated clothing and wash before reuse.

In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.

Collect spillage.

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>C₆H₁₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular weight</td>
<td>84.16 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>110-82-7</td>
</tr>
<tr>
<td>EC-No.</td>
<td>203-806-2</td>
</tr>
<tr>
<td>Index-No.</td>
<td>601-017-00-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclohexane</td>
<td>Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; H225, H304, H315, H336, H400</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.
If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 **Most important symptoms and effects, both acute and delayed**
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 **Indication of any immediate medical attention and special treatment needed**
No data available

5. **FIREFIGHTING MEASURES**

5.1 **Extinguishing media**
*Suitable extinguishing media*
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 **Special hazards arising from the substance or mixture**
No data available

5.3 **Advice for firefighters**
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 **Further information**
Use water spray to cool unopened containers.

6. **ACCIDENTAL RELEASE MEASURES**

6.1 **Personal precautions, protective equipment and emergency procedures**
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 **Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 **Methods and materials for containment and cleaning up**
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 **Reference to other sections**
For disposal see section 13.

7. **HANDLING AND STORAGE**

7.1 **Precautions for safe handling**
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 **Conditions for safe storage, including any incompatibilities**
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Flammable liquids

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. **EXPOSURE CONTROLS/PERSONAL PROTECTION**

8.1 **Control parameters**
Components with workplace control parameters
<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclohexane</td>
<td>110-82-7</td>
<td>TWA</td>
<td>100.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

**Remarks**

Central Nervous System impairment

<table>
<thead>
<tr>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>300.000000 ppm</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td>1,050.000000 mg/m3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
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<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>300.000000 ppm</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>1,050.000000 mg/m3</td>
<td></td>
</tr>
</tbody>
</table>

The value in mg/m3 is approximate.

### 8.2 Exposure controls

#### Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

#### Personal protective equipment

**Eye/face protection**

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

- **Full contact**
  - Material: Nitrile rubber
  - Minimum layer thickness: 0.4 mm
  - Break through time: 480 min
  - Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

- **Splash contact**
  - Material: Nitrile rubber
  - Minimum layer thickness: 0.11 mm
  - Break through time: 35 min
  - Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

**data source:** KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: liquid
   Colour: colourless

b) Odour
   No data available

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: 4 - 7 °C (39 - 45 °F) - lit.

f) Initial boiling point and boiling range
   80.7 °C (177.3 °F) - lit.

g) Flash point
   -17.99 °C (-0.38 °F) - closed cup

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   Upper explosion limit: 9 %(V)
   Lower explosion limit: 1 %(V)

k) Vapour pressure
   225.0 hPa (168.8 mmHg) at 37.7 °C (99.9 °F)
   102.7 hPa (77.0 mmHg) at 20.0 °C (68.0 °F)

l) Vapour density
   No data available

m) Relative density
   0.779 g/cm3 at 25 °C (77 °F)

n) Water solubility
   No data available

o) Partition coefficient: n-octanol/water
   log Pow: 3.44

p) Auto-ignition temperature
   260.0 °C (500.0 °F)

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information
   No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
    No data available

10.2 Chemical stability
    Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
    Vapours may form explosive mixture with air.

10.4 Conditions to avoid
    Heat, flames and sparks.

10.5 Incompatible materials
    Strong oxidizing agents
10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 12,705 mg/kg
LC50 Inhalation - Rat - 4 h - 34,000 mg/l
(OECD Test Guideline 403)
LD50 Dermal - Rabbit - > 2,000 mg/kg
No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: GU6300000
Central nervous system depression, Drowsiness, Irritability, Dizziness, Gastrointestinal disturbance, Lung irritation, chest pain, pulmonary edema

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish flow-through test LC50 - Pimephales promelas (fathead minnow) - 4.53 mg/l -
Toxicity to daphnia and other aquatic invertebrates

Immobilization EC50 - Daphnia magna (Water flea) - 0.9 mg/l - 48 h
(OECD Test Guideline 202)

Toxicity to algae
EC50 - Pseudokirchneriella subcapitata (green algae) - 3.4 mg/l - 72 h
(OECD Test Guideline 201)

12.2 Persistence and degradability

Biodegradability
Result: - Readily biodegradable

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1145  Class: 3  Packing group: II
Proper shipping name: Cyclohexane
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1145  Class: 3  Packing group: II  EMS-No: F-E, S-D
Proper shipping name: CYCLOHEXANE
Marine pollutant:yes

IATA
UN number: 1145  Class: 3  Packing group: II
Proper shipping name: Cyclohexane

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Cyclohexane</td>
<td>110-82-7</td>
<td>2007-07-01</td>
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</table>

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard
16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute  Acute aquatic toxicity
Asp. Tox.  Aspiration hazard
Flam. Liq.  Flammable liquids
H225  Highly flammable liquid and vapour.
H304  May be fatal if swallowed and enters airways.
H315  Causes skin irritation.
H336  May cause drowsiness or dizziness.
H400  Very toxic to aquatic life.
Skin Irrit.  Skin irritation
STOT SE  Specific target organ toxicity - single exposure

HMIS Rating
Health hazard:  2
Chronic Health Hazard:
Flammability:  3
Physical Hazard  0

NFPA Rating
Health hazard:  2
Fire Hazard:  3
Reactivity Hazard:  0

Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8  Revision Date: 03/07/2015  Print Date: 02/23/2016
SECTION 1 - CHEMICAL PRODUCT and COMPANY IDENTIFICATION
Catalog Number: S-10875M1
Description: 4,4'-DDE
Product is: Solution
Other Name(s): 1,1-Dichloro-2,2-bis[p-chlorophenyl]ethylene/p,p'-DDE/1,1-(Dichloroethenylidene)bis[4-chlorobenzene]
Supplied by CHEM SERVICE, Inc. PO BOX 599, WEST CHESTER, PA 19381 (610)-692-3026
EMERGENCY PHONE: 1-610-692-3026

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS
CAS No.: 72-55-9
Description: 4,4'-DDE Solution
Concentration: 100ug/mL in Methanol
EINECS No.: 200-784-6
Hazard Symbols: XN

SECTION 3 - HAZARDS IDENTIFICATION
Contact lenses should not be worn in the laboratory. All chemicals should be considered hazardous - Avoid direct physical contact!

For the solvent: Methanol

Health Risks: May be fatal if absorbed through the skin! Repeated exposure to vapors and/or dust can cause eye injury. May be fatal if inhaled! Can cause cardiovascular system injury. Exposure can cause liver damage. Exposure can cause kidney damage. May be fatal or cause blindness if swallowed. Can cause gastro-intestinal disturbances. Can cause convulsions.

Property 65: Data Not Available

SECTION 4 - FIRST AID MEASURES
An antidote is a substance intended to counteract the effect of a poison. It should be administered only by a physician or trained emergency personnel. Medical advice can be obtained from a POISON CONTROL CENTER.

For the solvent: Methanol
First Aid: In case of contact: Flush eyes continuously with water for 15-20 minutes. Flush skin with water for 15-20 minutes. If patient has stopped breathing administer artificial respiration. If patient is in cardiac arrest administer CPR. Continue life supporting measures until medical assistance has arrived. Do not wear shoes or clothing until absolutely free of all chemical odors. Get medical attention if necessary. If no burns have occurred-use soap and water to cleanse skin. If inhaled remove patient to fresh air. Administer oxygen if patient is having difficulty breathing. If swallowed do not induce vomiting.
SECTION 5 - FIRE AND EXPLOSION DATA
For the solvent: Methanol

Flash Point: 11°C This is a flammable chemical.
Extinguishing Media: Carbon dioxide or dry chemical powder. DO NOT USE WATER!
Upper Explosion Limit: 36%
Lower Explosion Limit: 6.0%
Autoignition Temperature: 464°C

NFPA Scale: 0 - Least, 1 - Slight, 2 - Moderate, 3 - High, 4 - Severe

SECTION 6 - ACCIDENTAL RELEASE MEASURES
Spills or Leaks: Evacuate area. Wear appropriate OSHA regulated equipment. Ventilate area.
Absorb on vermiculite or similar material. Sweep up and place in an appropriate container.
Hold for disposal.

Wash contaminated surfaces to remove any residue.
Remove contaminated clothing and wash before reuse.

SECTION 7 - HANDLING AND STORAGE
Handling: This chemical should be handled only in a hood. Eye shields should be worn.
Use appropriate OSHA/MSHA approved safety equipment. Avoid contact with skin,
eyes and clothing. Avoid ingestion and inhalation. Wash thoroughly after handling.

Storage:
Store in a cool dry place. Store only with compatible chemicals.
Keep tightly closed.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION
For the solvent: Methanol

OSHA PEL (TWA): 200 ppm (260 mg/m3)
ACGIH TLV (TWA): 200 ppm (262 mg/m3)
ACGIH TLV (STEL): Data Not Available

Personal Protective Equipment
Eyes: Wear Safety Glasses.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to minimize contact with skin.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 requirements must
be followed whenever workplace conditions warrant a respirators use.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES
For the solvent: Methanol

Color: Colorless
Phase: Liquid
Melting Point: -98°C
Boiling Point: 64.6°C
Specific Gravity: 0.791g/mL
Vapor Density: 1.11
Vapor Pressure: 130.3 hPa @ 20°C
Solubility in Water: Completely miscible.
Odor: Data Not Available
Evaporation Rate (Butyl acetate=1): Data Not Available
Molecular Weight: 32.05
Molecular Formula: CH4O

SECTION 10 - STABILITY AND REACTIVITY
For the solvent: Methanol

Reacts with Acid halides and anhydrides. Flammable. Incompatible with strong acids. Incompatible with strong reducing agents. Incompatible with strong oxidizing agents. Decomposition liberates toxic fumes. Hygroscopic. Incompatible with active metals (e.g. Sodium).

SECTION 11 - TOXICOLOGY INFORMATION
The primary hazards for this solution are predominantly from the solvent.

For the solvent: Methanol

RTECS: PC1400000
Oral Rat or Mouse LD50: 5628 mg/kg
Dermal Rat or Mouse LD50: N/A mg/kg
Rat or Mouse LC50: 64000 ppm/8H
Carcinogenicity
OSHA: NO
IARC: NO
NTP: NO
ACGIH: NO
NIOSH: NO
Other: NO

Property 65: Data Not Available

SECTION 12 - ECOLOGICAL INFORMATION
Ecotoxicity: Not Available
Environmental Fate: Not Available

SECTION 13 - DISPOSAL CONSIDERATIONS
Disposal: Dispose in accordance with Federal, State and Local regulations.

SECTION 14 - TRANSPORTATION INFORMATION
For the solvent: Methanol

UN Number: UN1230
Class: 3
Packing Group: II
Proper Shipping Name: Methanol

SECTION 15 - REGULATORY INFORMATION
For the solvent: Methanol

European Labeling in Accordance with EC Directives
Hazard Symbols: T F
Risk Phrases
R11 Highly Flammable.
R23/25 Toxic by inhalation and if swallowed.

Safety Phrases
S16 Keep away from sources of ignition- No smoking.
S2 Keep out of reach of children.
Avoid contact with the skin.

In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

Keep container tightly closed

SECTION 16 - OTHER INFORMATION

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded MSDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

This Material Safety Data Sheet (MSDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an MSDS for a solution or mixture the user should refer to the MSDS for every component of the solution or mixture. Chem Service warrants that this MSDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This MSDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES.

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This product is furnished FOR LABORATORY USE ONLY!
Safety data for dibenz(a,h)anthracene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2:5,6-benzanthracene, 1,2:5,6-dibenzanthracene, dibenzo(a,h)anthracene, DBA, 1,2,5,6-DBA
Use: a common pollutant in smoke and used oils
Molecular formula: C_{22}H_{14}
CAS No: 53-70-3
EINECS No: 200-181-8
Annex I Index. No: 601-041-00-2

Physical data

Appearance: white to light yellow crystalline solid
Melting point: 266 - 267 C
Boiling point: 524 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.28
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.
Toxicology

Harmful if swallowed or inhaled. Experimental carcinogen, tumorigen and neoplastigen. IARC probable human carcinogen.

**Toxicity data**
(The meaning of any toxicological abbreviations which appear in this section is given [here](#).)
IVN-MUS LDLO 10 mg kg\(^{-1}\)

**Risk phrases**
(The meaning of any risk phrases which appear in this section is given [here](#).)
R45 R50 R53.

Environmental information

Harmful in the environment - may cause long-term damage.

Transport information

(The meaning of any UN hazard codes which appear in this section is given [here](#).)
Non-hazardous for air, sea and road freight.

Personal protection

Safety glasses, gloves, good ventilation. Handle as a possible carcinogen.

**Safety phrases**
(The meaning of any safety phrases which appear in this section is given [here](#).)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on October 8, 2006. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date. Note also that the information on the PTCL Safety web site, where this page was hosted, has been copied onto many other sites, often without permission. If you have any doubts about the veracity of the information that you are viewing, or have any queries, please check the URL that your web browser displays for this page. If the URL begins "http://msds.chem.ox.ac.uk/" the page is maintained by the Safety Officer in Physical Chemistry at Oxford University. If not, this page is a copy made by some other person and we have no responsibility for it.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: Dibenzofuran
Product Number: 236373
Brand: Aldrich
CAS-No.: 132-64-9

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Hazard statement(s)</th>
<th>Precautionary statement(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning</td>
<td>H302: Harmful if swallowed.</td>
<td>P264: Wash skin thoroughly after handling.</td>
</tr>
<tr>
<td></td>
<td>H411: Toxic to aquatic life with long lasting effects.</td>
<td>P270: Do not eat, drink or smoke when using this product.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P273: Avoid release to the environment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P301 + P312 + P330: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P391: Collect spillage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P501: Dispose of contents/container to an approved waste disposal plant.</td>
</tr>
</tbody>
</table>

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none
3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Synonyms</th>
<th>Diphenylene oxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>C\textsubscript{12}H\textsubscript{8}O</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>168.19 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>132-64-9</td>
</tr>
<tr>
<td>EC-No.</td>
<td>205-071-3</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dibenzofuran</td>
<td>Acute Tox. 4; Aquatic Acute 2; Aquatic Chronic 2; H302, H411</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.
For personal protection see section 8.
6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSOAL PROTECTION

8.1 Control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an
industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Type</th>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>Appearance</td>
<td>Form: crystalline, Colour: white, beige</td>
</tr>
<tr>
<td>b)</td>
<td>Odour</td>
<td>No data available</td>
</tr>
<tr>
<td>c)</td>
<td>Odour Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d)</td>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>e)</td>
<td>Melting point/freezing point</td>
<td>Melting point/range: 80 - 82 °C (176 - 180 °F) - lit.</td>
</tr>
<tr>
<td>f)</td>
<td>Initial boiling point and boiling range</td>
<td>154 - 155 °C (309 - 311 °F) at 27 hPa (20 mmHg) - lit.</td>
</tr>
<tr>
<td>g)</td>
<td>Flash point</td>
<td>130.0 °C (266.0 °F) - closed cup</td>
</tr>
<tr>
<td>h)</td>
<td>Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>i)</td>
<td>Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>j)</td>
<td>Upper/lower flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>k)</td>
<td>Vapour pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>l)</td>
<td>Vapour density</td>
<td>No data available</td>
</tr>
<tr>
<td>m)</td>
<td>Relative density</td>
<td>No data available</td>
</tr>
<tr>
<td>n)</td>
<td>Water solubility</td>
<td>No data available</td>
</tr>
<tr>
<td>o)</td>
<td>Partition coefficient: n-octanol/water</td>
<td>log Pow: 3.77</td>
</tr>
<tr>
<td>p)</td>
<td>Auto-ignition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>q)</td>
<td>Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>r)</td>
<td>Viscosity</td>
<td>No data available</td>
</tr>
<tr>
<td>s)</td>
<td>Explosive properties</td>
<td>No data available</td>
</tr>
<tr>
<td>t)</td>
<td>Oxidizing properties</td>
<td>No data available</td>
</tr>
</tbody>
</table>

#### 9.2 Other safety information

No data available
10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available
Aspiration hazard
No data available

Additional Information
RTECS: HP4430000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
NOEC - Cyprinodon variegatus (sheepshead minnow) - 1 mg/l - 96.0 h
LC50 - Pimephales promelas (fathead minnow) - 1.05 mg/l - 96.0 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenzofuran)
Reportable Quantity (RQ): 100 lbs
Marine pollutant: yes
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Dibenzofuran)
Marine pollutant: yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenzofuran)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:
CAS-No. Revision Date
Dibenzofuran 132-64-9 2007-07-01

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
CAS-No. Revision Date
Dibenzofuran 132-64-9 2007-07-01

Pennsylvania Right To Know Components
CAS-No. Revision Date
Dibenzofuran 132-64-9 2007-07-01

New Jersey Right To Know Components
CAS-No. Revision Date
Dibenzofuran 132-64-9 2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Acute toxicity
Aquatic Acute Acute aquatic toxicity
Aquatic Chronic Chronic aquatic toxicity
H302 Harmful if swallowed.
H401 Toxic to aquatic life.
H411 Toxic to aquatic life with long lasting effects.

HMIS Rating
Health hazard: 1
Chronic Health Hazard: 
Flammability: 1
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 1
Reactivity Hazard: 0

Further information
Copyright 2014 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
Version: 3.7 Revision Date: 11/25/2014 Print Date: 01/29/2016
SAFETY DATA SHEET
Halocarbon R-12 (Dichlorodifluoromethane)

Section 1. Identification

GHS product identifier : Halocarbon R-12 (Dichlorodifluoromethane)
Chemical name : dichlorodifluoromethane
Other means of identification : ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12
Product use : Synthetic/Analytical chemistry.
Synonym : ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12
SDS # : 001018
Supplier’s details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253
Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture : GASES UNDER PRESSURE - Liquefied gas
HAZARDOUS TO THE OZONE LAYER - Category 1

GHS label elements
Hazard pictograms :

Signal word : Warning
Hazard statements : Contains gas under pressure; may explode if heated.
May cause frostbite.
May displace oxygen and cause rapid suffocation.
Harms public health and the environment by destroying ozone in the upper atmosphere.

Precautionary statements
General : Read and follow all Safety Data Sheets (SDS’S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position.
Prevention : Use and store only outdoors or in a well ventilated place.
Response : Not applicable.
Storage : Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal : Refer to manufacturer/supplier for information on recovery/recycling.

Date of issue/Date of revision : 5/21/2015.
Date of previous issue : 5/21/2015.
Version : 2
Halocarbon R-12 (Dichlorodifluoromethane)

Section 2. Hazards identification

Hazard not otherwise classified: Liquid can cause burns similar to frostbite.

Section 3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Substance/mixture</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical name</td>
<td>dichlorodifluoromethane</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>CAS number/other identifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane, dichlorodifluoro-</td>
<td>CAS number: 75-71-8 Product code: 001018</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Section 4. First aid measures

**Description of necessary first aid measures**

**Eye contact**: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

**Inhalation**: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

**Skin contact**: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. In case of contact with liquid, warm frozen tissues slowly with lukewarm water and get medical attention. Do not rub affected area. Wash clothing before reuse. Clean shoes thoroughly before reuse.

**Ingestion**: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if adverse health effects persist or are severe. Ingestion of liquid can cause burns similar to frostbite. If frostbite occurs, get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. As this product rapidly becomes a gas when released, refer to the inhalation section.

**Most important symptoms/effects, acute and delayed**

**Potential acute health effects**

**Eye contact**: Liquid can cause burns similar to frostbite.

**Inhalation**: Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

**Date of issue/Date of revision**: 5/21/2015. **Date of previous issue**: 5/21/2015. **Version**: 2
Section 4. First aid measures

**Skin contact**: Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

**Frostbite**: Try to warm up the frozen tissues and seek medical attention.

**Ingestion**: Ingestion of liquid can cause burns similar to frostbite.

**Over-exposure signs/symptoms**

**Eye contact**: Adverse symptoms may include the following:
- Frostbite

**Inhalation**: No specific data.

**Skin contact**: Adverse symptoms may include the following:
- Frostbite

**Ingestion**: Adverse symptoms may include the following:
- Frostbite

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to physician**: In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

**Specific treatments**: No specific treatment.

**Protection of first-aiders**: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

**Extinguishing media**

**Suitable extinguishing media**: Use an extinguishing agent suitable for the surrounding fire.

**Unsuitable extinguishing media**: None known.

**Specific hazards arising from the chemical**

- Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

**Hazardous thermal decomposition products**

- Decomposition products may include the following materials:
  - Carbon dioxide
  - Carbon monoxide
  - Halogenated compounds
  - Carbonyl halides

**Special protective actions for fire-fighters**: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

**Special protective equipment for fire-fighters**: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. For incidents involving large quantities, thermally insulated undergarments and thick textile or leather gloves should be worn.
Section 6. Accidental release measures

**Personal precautions, protective equipment and emergency procedures**

**For non-emergency personnel**
No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

**For emergency responders**
If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

**Environmental precautions**
Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). May be harmful to the environment if released in large quantities.

**Methods and materials for containment and cleaning up**

**Small spill**
Immediately contact emergency personnel. Stop leak if without risk.

**Large spill**
Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

**Precautions for safe handling**

**Protective measures**
Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Avoid breathing gas. Avoid release to the environment. Refer to special instructions/safety data sheet. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

**Advice on general occupational hygiene**
Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

**Conditions for safe storage, including any incompatibilities**
Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

**Control parameters**

**Occupational exposure limits**
Section 8. Exposure controls/personal protection

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
</table>
| Methane, dichlorodifluoro-| ACGIH TLV (United States, 3/2012).  
TWA: 4950 mg/m³ 8 hours.  
TWA: 1000 ppm 8 hours.  
NIOSH REL (United States, 1/2013).  
TWA: 4950 mg/m³ 10 hours.  
TWA: 1000 ppm 10 hours.  
OSHA PEL (United States, 6/2010).  
TWA: 4950 mg/m³ 8 hours.  
TWA: 1000 ppm 8 hours.  
TWA: 4950 mg/m³ 8 hours.  
TWA: 1000 ppm 8 hours. |

**Appropriate engineering controls**: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

**Environmental exposure controls**: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

**Individual protection measures**

**Hygiene measures**: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

**Eye/face protection**: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

**Skin protection**

**Hand protection**: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. If contact with the liquid is possible, insulated gloves suitable for low temperatures should be worn. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

**Body protection**: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Other skin protection**: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Respiratory protection**: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Liquefied gas]
Color : Colorless.
Molecular weight : 120.91 g/mole
Molecular formula : C-Cl2-F2
Boiling/condensation point : -29.8°C (-21.6°F)
Melting/freezing point : -158°C (-252.4°F)
Critical temperature : 111.85°C (233.3°F)
Odor : Characteristic.
Odor threshold : Not available.
pH : Not available.
Flash point : [Product does not sustain combustion.]
Burning time : Not applicable.
Burning rate : Not applicable.
Evaporation rate : Not available.
Flammability (solid, gas) : Not available.
Lower and upper explosive (flammable) limits : Not available.
Vapor pressure : 84.9 (psia)
Vapor density : 4.2 (Air = 1)
Specific Volume (ft³/lb) : 3.1746
Gas Density (lb/ft³) : 0.315
Relative density : Not applicable.
Solubility : Not available.
Solubility in water : 0.3 g/l
Partition coefficient: n-octanol/water : 2.16
Auto-ignition temperature : Not available.
Decomposition temperature : Not available.
SADT : Not available.
Viscosity : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.
Chemical stability : The product is stable.
Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid : No specific data.
Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
**Section 10. Stability and reactivity**

**Hazardous polymerization**  
Under normal conditions of storage and use, hazardous polymerization will not occur.

**Section 11. Toxicological information**

**Information on toxicological effects**

**Acute toxicity**  
Not available.

**Irritation/Corrosion**  
Not available.

**Sensitization**  
Not available.

**Mutagenicity**  
Not available.

**Carcinogenicity**  
Not available.

**Reproductive toxicity**  
Not available.

**Teratogenicity**  
Not available.

**Specific target organ toxicity (single exposure)**  
Not available.

**Specific target organ toxicity (repeated exposure)**  
Not available.

**Aspiration hazard**  
Not available.

**Information on the likely routes of exposure**  
Not available.

**Potential acute health effects**

- **Eye contact**: Liquid can cause burns similar to frostbite.
- **Inhalation**: Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.
- **Skin contact**: Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.
- **Ingestion**: Ingestion of liquid can cause burns similar to frostbite.

**Symptoms related to the physical, chemical and toxicological characteristics**

- **Eye contact**: Adverse symptoms may include the following: frostbite
- **Inhalation**: No specific data.
- **Skin contact**: Adverse symptoms may include the following: frostbite
Section 11. Toxicological information

Ingestion
- Adverse symptoms may include the following: frostbite

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure
- Potential immediate effects: Not available.
- Potential delayed effects: Not available.

Long term exposure
- Potential immediate effects: Not available.
- Potential delayed effects: Not available.

Potential chronic health effects
- Not available.

General: No known significant effects or critical hazards.
Carcinogenicity: No known significant effects or critical hazards.
Mutagenicity: No known significant effects or critical hazards.
Teratogenicity: No known significant effects or critical hazards.
Developmental effects: No known significant effects or critical hazards.
Fertility effects: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates
- Not available.

Section 12. Ecological information

Toxicity
- Not available.

Persistence and degradability
- Not available.

Bioaccumulative potential

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>LogP&lt;sub&gt;ow&lt;/sub&gt;</th>
<th>BCF</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane, dichlorodifluoro-</td>
<td>2.16</td>
<td>6.17</td>
<td>low</td>
</tr>
</tbody>
</table>

Mobility in soil
- Soil/water partition coefficient (K<sub>oc</sub>): Not available.

Other adverse effects
- No known significant effects or critical hazards.
Section 13. Disposal considerations

Disposal methods
The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

United States - RCRA Toxic hazardous waste "U" List

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS #</th>
<th>Status</th>
<th>Reference number</th>
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<tbody>
<tr>
<td>Dichlorodifluoromethane; Methane, dichlorodifluoro-</td>
<td>75-71-8</td>
<td>Listed</td>
<td>U075</td>
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Section 14. Transport information

<table>
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<tr>
<th>DOT</th>
<th>TDG</th>
<th>Mexico</th>
<th>IMDG</th>
<th>IATA</th>
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<td>UN number</td>
<td>UN1028</td>
<td>UN1028</td>
<td>UN1028</td>
<td>UN1028</td>
</tr>
<tr>
<td>UN proper shipping name</td>
<td>DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12</td>
<td>DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12</td>
<td>DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12</td>
<td>DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
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<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Packing group
- - - - -

Environment

Additional information
- Reportable quantity
5000 lbs / 2270 kg
Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.

- Limited quantity
Yes.

- Packaging instruction
Passenger aircraft
Quantity limitation: 75 kg

- Cargo aircraft
Quantity limitation: 150 kg

- Special provisions
T50

Explosive Limit and Limited Quantity Index
0.125

Passenger Carrying Road or Rail Index
75

Passenger and Cargo Aircraft
Quantity limitation: 75 kg
Cargo Aircraft Only
Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 14. Transport information

Special precautions for user: Transport within user’s premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory information

U.S. Federal regulations

- TSCA 8(a) CDR Exempt/Partial exemption: Not determined
- TSCA 12(b) annual export notification: dichlorodifluoromethane
- United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)
- Not listed

Clean Air Act Section 602 Class I Substances
- Listed

Clean Air Act Section 602 Class II Substances
- Not listed

DEA List I Chemicals (Precursor Chemicals)
- Not listed

DEA List II Chemicals (Essential Chemicals)
- Not listed

SARA 302/304
Composition/information on ingredients

No products were found.

SARA 304 RQ
- Not applicable.

SARA 311/312
Classification: Sudden release of pressure

Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
</table>

SARA 313

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form R - Reporting requirements</td>
<td>dichlorodifluoromethane</td>
<td>75-71-8</td>
</tr>
<tr>
<td>Supplier notification</td>
<td>dichlorodifluoromethane</td>
<td>75-71-8</td>
</tr>
</tbody>
</table>

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

- Massachusetts: This material is listed.
- New York: This material is listed.

Date of issue/Date of revision: 5/21/2015.
Date of previous issue: 5/21/2015.
Version: 2
Section 15. Regulatory information

New Jersey : This material is listed.
Pennsylvania : This material is listed.
Canada inventory : This material is listed or exempted.

International regulations

International lists:
- Australia inventory (AICS): This material is listed or exempted.
- China inventory (IECSC): This material is listed or exempted.
- Japan inventory: This material is listed or exempted.
- Korea inventory: This material is listed or exempted.
- Malaysia Inventory (EHS Register): Not determined.
- New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
- Philippines inventory (PICCS): This material is listed or exempted.
- Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals: Not listed
Chemical Weapons Convention List Schedule II Chemicals: Not listed
Chemical Weapons Convention List Schedule III Chemicals: Not listed

Canada

WHMIS (Canada)
Class A: Compressed gas.
- CEPA Toxic substances: This material is listed.
- Canadian ARET: This material is not listed.
- Canadian NPRI: This material is listed.
- Alberta Designated Substances: This material is not listed.
- Ontario Designated Substances: This material is not listed.
- Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements: Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Date of issue/Date of revision : 5/21/2015.
Date of previous issue : 5/21/2015.
Version : 2

Powered by IHS
Section 16. Other information

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 5/21/2015.
Date of issue/Date of revision : 5/21/2015.
Date of previous issue : 5/21/2015.
Version : 2

Key to abbreviations

ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
UN = United Nations
ACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

Other special considerations : WARNING: Contains (Dichlorodifluoromethane), a substance which harms the public health and environment by destroying ozone in the upper atmosphere.

Notice to reader

Powered by IHS
Section 16. Other information

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.
MSDS SUMMARY SHEET

Manufacturer:
Name: PHILLIPS PETROLEUM COMPANY
Address 1:  
Address 2:
Address 3:  
CSZ: BARTLESVILLE  State: OK  Zipcode: 74004
Emergency phone: (800) 424-9300
Business phone: 800-762-0942

Product:

Ferndale MSDS#: 1354  Version #: 6
Manufacturer MSDS#: 0041
Current?: 2002
Name: NO. 2 DIESEL FUEL

Synonyms:
  CARB Diesel TF3
  CARB Diesel
  CARB Diesel 10%
  Diesel Fuel Oil
  EPA Low Sulfur Diesel Fuel
  EPA Low Sulfur Diesel Fuel – Dyed
  EPA Off Road High Sulfur Diesel – Dyed
  Fuel Oil No. 2 – CAS # 68476-30-2
  No. 2 Diesel Fuel Oil
  No. 2 Fuel Oil – Non Hiway – Dyed
  No. 2 High Sulfur Diesel – Dyed
  No. 2 Low Sulfur Diesel - Dyed
  No. 2 Low Sulfur Diesel - Undyed
  Crude column 3rd IR
  Crude column 3rd side cut
  Atmospheric tower 3rd side cut
  Ultra Low Sulfur Diesel No. 2
  Finished Diesel
  DHT Reactor Feed
  Straight Run Diesel
  Diesel
  Middle Distillate

Product/Catalog Numbers:
MSDS Date: 01/01/2002  (received: 01/14/2002)

NFPA codes:
Health: 0  Flammability: 2  Reactivity: 0
MATERIAL SAFETY DATA SHEET
No. 2 Diesel Fuel

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: No. 2 Diesel Fuel
Product Code: Multiple
SAP Code: 1354
Synonyms:
- CARB Diesel TF3
- CARB Diesel
- CARB Diesel 10%
- Diesel Fuel Oil
- EPA Low Sulfur Diesel Fuel
- EPA Low Sulfur Diesel Fuel – Dyed
- EPA Off Road High Sulfur Diesel – Dyed
- Fuel Oil No. 2 – CAS # 68476-30-2
- No. 2 Diesel Fuel Oil
- No. 2 Fuel Oil – Non Hiway – Dyed
- No. 2 High Sulfur Diesel – Dyed
- No. 2 Low Sulfur Diesel - Dyed
- No. 2 Low Sulfur Diesel – Undyed
- No. 2 Ultra Low Sulfur Diesel – Dyed
- No. 2 Ultra Low Sulfur Diesel - Undyed

Intended Use: Fuel

Chemical Family:Phillip’s Petroleum Company
Responsible Party: Bartlesville, Oklahoma 74004

For Additional MSDSs: 800-762-0942
Technical Information:
The intended use of this product is indicated above. If any additional use is known, please contact us at the
Technical Information number listed.

EMERGENCY OVERVIEW

24 Hour Emergency Telephone Numbers:
Spill, Leak, Fire or Accident Call CHEMTREC
California Poison Control System: 800-356-3120
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

Health Hazards/Precautionary Measures: Causes severe skin irritation. Aspiration hazard if swallowed. Can enter
lungs and cause damage. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Do not
taste or swallow. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Flammable liquid and vapor. Keep away from heat, sparks, flames,
static electricity or other sources of ignition.

Appearance: Straw-colored to dyed red
Physical Form: Liquid
Odor: Characteristic petroleum
2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>HAZARDOUS COMPONENTS</th>
<th>% VOLUME</th>
<th>LIMITS</th>
<th>AGENCY</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Fuel No. 2</td>
<td>100</td>
<td>100* mg/m³</td>
<td>ACGIH</td>
<td>TWA-SKIN</td>
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<tr>
<td>CAS# 68476-34-6</td>
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<td>ACGIH</td>
<td>STEL</td>
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<td></td>
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<td>10ppm</td>
<td>OSHA</td>
<td>TWA</td>
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<td></td>
<td></td>
<td>250ppm</td>
<td>NIOSH</td>
<td>IDLH</td>
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</table>

All components are listed on the TSCA inventory.

Tosco Low Sulfur No. 2 Diesel meets the specifications of 40 CFR 60.41 for low sulfur diesel fuel.

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

*Proposed ACGIH (1999)

3. HAZARDS IDENTIFICATION

Potential Health Effects:

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Severe skin irritant. Contact may cause redness, itching, burning, and severe skin damage. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin, leading to dermatitis (inflammation). Not actually toxic by skin absorption, but prolonged or repeated skin contact may be harmful (see Section 11).

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): Low degree of toxicity by ingestion. ASPIRATION HAZARD – This material can enter lungs during swallowing or vomiting and cause lung inflammation and damage.

Signs and Symptoms: Effects of overexposure may include irritation of the nose and throat, irritation of the digestive tract, nausea, diarrhea and transient excitement followed by signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue).

Cancer: Possible skin cancer hazard (see Sections 11 and 14).

Target Organs: There is limited evidence from animal studies that overexposure may cause injury to the kidney (see Section 11).

Developmental: Inadequate data available for this material.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders and kidney disorders.
4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Immediately remove contaminated shoes, clothing, and constrictive jewelry and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek immediate medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water. If irritation or redness develops, seek immediate medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): Aspiration hazard; Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

5. FIRE FIGHTING MEASURES

Flammable Properties: Flash Point: >125°F/>52°C
OSHA Flammability Class: Combustible liquid
LEL %: 0.3 / UEL %: 10.0
Autoignition Temperature: 500°F/260°C

Unusual Fire & Explosion Hazards: This material is flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, or mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.
6. ACCIDENTAL RELEASE MEASURES

Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof equipment is recommended.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Use foam on spills to minimize vapors (see Section 5). Spilled material may be absorbed into an appropriate material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharged. The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames. Use good personal hygiene practices.

High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing or high pressure hydraulic oil equipment.

“Empty” containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. “Empty” drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1 and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area “No Smoking or Open Flame.” Store only in approved containers. Keep away from incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentration below the established exposure limits (see Section 2), additional ventilation or exhaust systems may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).
Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with an organic vapor cartridge maybe used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer’s respirator selection guide). Use a positive pressure air supplied respirator if there is a potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA’s 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrants a respirator’s use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact, possible irritation and skin damage (see glove manufacturer literature for information on permeability). Depending on conditions of use, apron and/or arm covers may be necessary.

Eyes/face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse. It is recommended that impervious clothing be worn when skin contact is possible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1atm).

Appearance: Straw-colored to dyed red
Physical State: Liquid
Odor: Characteristic petroleum
pH: unavailable
Vapor Pressure (mm Hg): 0.40
Vapor Density (air=1): >3
Boiling Point/Range: 320-700°F / 160-371°C
Freezing/Melting Point: No Data
Solubility in Water: Negligible
Specific Gravity: 0.81-0.88 @ 60°F
Percent Volatile: Negligible
Evaporation Rate (nBuAc=1): <1
Viscosity: 32.6-40.0 SUS @ 100°F
Bulk Density: 7.08 lbs/gal
Flash Point: >125°F / >52°C
Flammable/Explosive Limits (%): LEL: 0.3 / UEL: 10.0

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Flammable liquid and vapor. Vapor can cause flash fire.

Conditions To Avoid: Avoid all possible sources of ignition (see Sections 5 and 7).

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc.
Hazardous Decomposition Products: The use of hydrocarbon fuels in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., oxides of carbon, sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels. ACGIH has included a TLV of 0.05 mg/m3 TWA for diesel exhaust particulate on its 1999 Notice of Intended Changes. See Section 11 for additional information on hazards of engine exhaust.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Diesel Fuel No. 2 (CAS# 68476-34-6)

Carcinogenicity: Chronic dermal application of certain middle distillate streams contained in diesel fuel No. 2 resulted in an increased incidence of skin tumors in mice. This material has not been identified as carcinogen by NTP, IARC, or OSHA. Diesel exhaust is a probable cancer hazard based on tests with laboratory animals.

Target Organ(s): Limited evidence of renal impairment has been noted from a few case reports involving excessive exposure to diesel fuel No. 2.

Naphthalene (CAS# 91-20-3)

Carcinogenicity: Naphthalene has been evaluated in two year inhalation studies in both rats and mice. The National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has not been identified as a carcinogen by IARC or OSHA.

12. ECOLOGICAL INFORMATION

Not evaluated at this time

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced, would be a RCRA “characteristic” hazardous waste due to the characteristic(s) of ignitability (D001) and benzene (D018). If the material is spilled to soil or water, characteristic testing of the contaminated materials is recommended. Further, this material, once it becomes a waste, is subject to the land disposal restrictions in 40 CFR 268.40 and may require treatment prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent then the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container ?insate? could be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller containers, consult with state and local regulations and disposal authorities.

14. TRANSPORT INFORMATION

DOT Shipping Description: Diesel Fuel, NA1983
Non-Bulk Package Marking: Diesel Fuel, 3, NA 1993, III
15. REGULATORY INFORMATION

EPA SARA 311/312 (Title III Hazard Categories):
Acute Health: Yes
Chronic Health: Yes
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

SARA 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS Number</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>--- None known</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

California Proposition 65:
Warning: This material contains the following chemicals which are known to the state of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

<table>
<thead>
<tr>
<th>Component</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Cancer, Developmental and Reproductive Toxicant</td>
</tr>
<tr>
<td>Toluene</td>
<td>Developmental Toxicant</td>
</tr>
</tbody>
</table>

Diesel engine exhaust, while not a component of this material, is on the Proposition 65 list of chemicals known to the State of California to cause cancer.

Carcinogen Identification:
This material has not been identified as a carcinogen by NTP, IARC, or OSHA. See Section 11 for carcinogenicity information of individual components, if any. Diesel exhaust is a probable cancer hazard based on tests in laboratory animals. It has been identified as carcinogen by IARC.

EPA (CERCLA Reportable Quantity: None

16. OTHER INFORMATION

Issue Date: 01/01/02
Previous Issue Date: 05/15/01
Product Code: Multiple
Revised Sections: None
Previous Product Code: Multiple
MSDS Number: 0041

Disclaimer of Expressed and Implied Warranties:
The information presented in this Material Data Safety Sheet is based on data believed to be accurate as of the date this Material Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THE PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.
### UltraLow Sulfur Diesel Product Specification

#### Ferndale Product Code: 34380xx (5) Product Code: ULSD2

#### (COMETS)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit</th>
<th>Limit</th>
<th>Test Procedure</th>
<th>Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water &amp; Sediment</td>
<td>Vol %</td>
<td>0.05 Max</td>
<td>D 2709</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Number</td>
<td>3.0 Max</td>
<td>D 1500</td>
<td></td>
</tr>
<tr>
<td>Haze Rating</td>
<td>Rating</td>
<td>2 Max</td>
<td>D 4176</td>
<td></td>
</tr>
<tr>
<td><strong>Composition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Residue (Ramsbottom)</td>
<td>Wt %</td>
<td>0.35 Max</td>
<td>D 524, D 189</td>
<td></td>
</tr>
<tr>
<td><strong>Vapor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90% Recovered</td>
<td>Deg; F</td>
<td>540 Min</td>
<td>D 86</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>Deg; F</td>
<td>640 Min</td>
<td>D 86</td>
<td></td>
</tr>
<tr>
<td>Gravity</td>
<td>Deg; F</td>
<td>125 Min (1)</td>
<td>D 93</td>
<td>130 F</td>
</tr>
<tr>
<td></td>
<td>API</td>
<td>30 Min</td>
<td>D 287, D4052</td>
<td></td>
</tr>
<tr>
<td><strong>Fluoride</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pour Point</td>
<td>Deg; F</td>
<td>See Season Table (6)</td>
<td>D 97</td>
<td></td>
</tr>
<tr>
<td>Cloud Point</td>
<td>Deg; F</td>
<td>See Season Table (6)</td>
<td>D 2500</td>
<td></td>
</tr>
<tr>
<td>Viscosity @ 104F</td>
<td>cSt</td>
<td>1.9 Min</td>
<td>D 445</td>
<td>10 F</td>
</tr>
<tr>
<td></td>
<td>cSt</td>
<td>4.1 Max</td>
<td>D 445</td>
<td></td>
</tr>
<tr>
<td>Lubricity, SLBOCLE</td>
<td>grams</td>
<td>3100 Min</td>
<td>D 6078</td>
<td>3300gm</td>
</tr>
<tr>
<td>Lubricity, HFRR</td>
<td>mm</td>
<td>.45</td>
<td>D 6079</td>
<td></td>
</tr>
<tr>
<td><strong>Combustion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cetane Index or Cetane Number (3,4)</td>
<td>Number</td>
<td>40.0 Min</td>
<td>D 976, D613</td>
<td>47.0</td>
</tr>
<tr>
<td><strong>Corrosion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Strip, 3hr @ 50 deg C</td>
<td>Number</td>
<td>3 Max (2)</td>
<td>D 130</td>
<td></td>
</tr>
<tr>
<td>Aromatics (4)</td>
<td>Vol %</td>
<td>35 Max</td>
<td>D 1319</td>
<td>25 %</td>
</tr>
<tr>
<td><strong>Contaminants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Sulfur</td>
<td>PPM</td>
<td>30 Max</td>
<td>D 2622, D4294</td>
<td>15-20 ppm</td>
</tr>
<tr>
<td>Water &amp; Sediment</td>
<td>Vol %</td>
<td>0.05 Max</td>
<td>D 1796</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>Wt %</td>
<td>0.01 Max</td>
<td>D 482</td>
<td></td>
</tr>
<tr>
<td><strong>Additives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cetane Improver</td>
<td>Lb/MBbl</td>
<td>675 Max</td>
<td>Undyed</td>
<td></td>
</tr>
<tr>
<td>Dye</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Minimum release specification is 125 deg. F. The refinery should target 135 deg. F.
2. Test result reported as a number and letter (e.g. 1a). Any letter is allowable as long as the number meets the spec shown.
3. Either specification must be met.
4. Either cetane index minimum or aromatics maximum must be met.
5. Winter cloud and pour specifications may be relaxed to the summer specifications by agreement with the customer.
6. Season Table

<table>
<thead>
<tr>
<th>Month</th>
<th>Product Code</th>
<th>Pour Point</th>
<th>Cloud Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan, Feb, Nov, Dec</td>
<td>WI</td>
<td>0 max (5)</td>
<td>14 max (5)</td>
</tr>
<tr>
<td>Mar - Oct</td>
<td>SU</td>
<td>15 max</td>
<td>24 max</td>
</tr>
</tbody>
</table>
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Diethyl phthalate

Product Number : W512206
Brand : Aldrich
CAS-No. : 84-66-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute aquatic toxicity (Category 3), H402

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram : none
Signal word : none

Hazard statement(s)
H402 Harmful to aquatic life.

Precautionary statement(s)
P273 Avoid release to the environment.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : DEP

Formula : C_{12}H_{14}O_{4}
Molecular weight : 222.24 g/mol
CAS-No. : 84-66-2
Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diethyl phthalate</td>
<td>Aquatic Acute 3; H402</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.
7. HANDLING AND STORAGE

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diethyl phthalate</td>
<td>84-66-2</td>
<td>TWA</td>
<td>5.000000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remarks Upper Respiratory Tract irritation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not classifiable as a human carcinogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5.000000 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEL</td>
<td>5 mg/m³</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.
**Body Protection**
Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Respiratory protection not required. For nuisance exposures use type OV/AG (US) or type ABEK (EU EN 14387) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

- **a)** Appearance
  - Form: liquid
  - Colour: light yellow
- **b)** Odour
  - No data available
- **c)** Odour Threshold
  - No data available
- **d)** pH
  - No data available
- **e)** Melting point/freezing point
  - Melting point/range: 3 °C (37 °F) - lit.
- **f)** Initial boiling point and boiling range
  - 298 - 299 °C (568 - 570 °F) - lit.
- **g)** Flash point
  - 156.0 °C (312.8 °F) - closed cup
- **h)** Evaporation rate
  - No data available
- **i)** Flammability (solid, gas)
  - No data available
- **j)** Upper/lower flammability or explosive limits
  - Lower explosion limit: 0.75 % (V)
- **k)** Vapour pressure
  - < 28 hPa (< 21 mmHg) at 25 °C (77 °F)
- **l)** Vapour density
  - 7.7 - (Air = 1.0)
- **m)** Relative density
  - 1.12 g/mL at 25 °C (77 °F)
- **n)** Water solubility
  - 0.932 g/l at 20 °C (68 °F) - OECD Test Guideline 105 - slightly soluble
- **o)** Partition coefficient: n-octanol/water
  - log Pow: 2.2 at 41 °C (106 °F)
- **p)** Auto-ignition temperature
  - 457.0 °C (854.6 °F)
- **q)** Decomposition temperature
  - No data available
- **r)** Viscosity
  - 11.53 mm2/s at 20 °C (68 °F) -
- **s)** Explosive properties
  - No data available
- **t)** Oxidizing properties
  - No data available

#### 9.2 Other safety information

- **Relative vapour density**
  - 7.7 - (Air = 1.0)

### 10. STABILITY AND REACTIVITY

#### 10.1 Reactivity

No data available
10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, acids

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 8,600 mg/kg

LC50 Inhalation - Rat - 6 h - > 4,640 mg/m3
LD50 Dermal - Rat - male and female - > 10,000 mg/kg
No data available

Skin corrosion/ Irritation
Skin - Rabbit
Result: No skin irritation - 24 h

Serious eye damage/ eye irritation
Eyes - Rabbit
Result: Moderate eye irritation

Respiratory or skin sensitisation
- Mouse
Result: Did not cause sensitisation on laboratory animals.
(OECD Test Guideline 429)

Germ cell mutagenicity
Mouse lymphocyte
Result: negative

Ames test
S. typhimurium
Result: negative

Carcinogenicity
Carcinogenicity - Mouse - Skin
Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Liver: Tumors.

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
Reproductive toxicity
Reproductive toxicity - Rat - Intraperitoneal
Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.

Reproductive toxicity - Mouse - male - Oral

Developmental Toxicity - Rat - Oral
Specific Developmental Abnormalities: Musculoskeletal system.

Developmental Toxicity - Mouse - Skin
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
Repeated dose toxicity
RTECS: TI1050000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish static test LC50 - Oncorhynchus mykiss (rainbow trout) - 12 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates static test LC50 - Daphnia magna (Water flea) - 90 mg/l - 48 h
Toxicity to algae static test EC50 - Desmodesmus subspicatus (Scenedesmus subspicatus) - 23 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability
Biodegradability aerobic - Exposure time 28 d
Result: 94.6 % - Readily biodegradable

12.3 Bioaccumulative potential
Bioaccumulation Lepomis macrochirus (Bluegill) - 21 d - 0.00942 mg/l
Bioconcentration factor (BCF): 117

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3082  Class: 9  Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Diethyl phthalate)
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components

Diethyl phthalate  CAS-No. 84-66-2  Revision Date 1994-04-01

Pennsylvania Right To Know Components

Diethyl phthalate  CAS-No. 84-66-2  Revision Date 1994-04-01

New Jersey Right To Know Components

Diethyl phthalate  CAS-No. 84-66-2  Revision Date 1994-04-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute  Acute aquatic toxicity  H402  Harmful to aquatic life.

HMIS Rating
Health hazard: 0
Chronic Health Hazard:
Flammability: 1
Physical Hazard 0

**NFPA Rating**
Health hazard: 0
Fire Hazard: 1
Reactivity Hazard: 0

**Further information**
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**Preparation Information**
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.9  Revision Date: 05/24/2016  Print Date: 06/20/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Endosulfan sulfate
Product Number: 36676
Brand: Sigma
CAS-No.: 1031-07-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 2), H300
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger
Hazard statement(s)
H300: Fatal if swallowed.
H410: Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)
P264: Wash skin thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P273: Avoid release to the environment.
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P321: Specific treatment (see supplemental first aid instructions on this label).
P330: Rinse mouth.
P391: Collect spillage.
P405: Store locked up.
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula : C$_9$H$_6$Cl$_6$O$_4$S
Molecular Weight : 422.92 g/mol
CAS-No. : 1031-07-8

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endosulfan sulfate</td>
<td>Acute Tox. 2; Aquatic Acute 1; Aquatic Chronic 1; H300, H410</td>
<td>-</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

**In case of eye contact**
Flush eyes with water as a precaution.

**If swallowed**
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

**Suitable extinguishing media**
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Sulphur oxides

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.
6.2 **Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 **Methods and materials for containment and cleaning up**
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 **Reference to other sections**
For disposal see section 13.

7. **HANDLING AND STORAGE**

7.1 **Precautions for safe handling**
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.
Normal measures for preventive fire protection. For precautions see section 2.2.

7.2 **Conditions for safe storage, including any incompatibilities**
Keep container tightly closed in a dry and well-ventilated place.

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. **EXPOSURE CONTROLS/PERSONAL PROTECTION**

8.1 **Control parameters**

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 **Exposure controls**

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

**Eye/face protection**
Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.
**Body Protection**
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

- **a) Appearance**
  - Form: solid

- **b) Odour**
  - no data available

- **c) Odour Threshold**
  - no data available

- **d) pH**
  - no data available

- **e) Melting point/freezing point**
  - 179.0 - 182.0 °C (354.2 - 359.6 °F)

- **f) Initial boiling point and boiling range**
  - no data available

- **g) Flash point**
  - no data available

- **h) Evaporation rate**
  - no data available

- **i) Flammability (solid, gas)**
  - no data available

- **j) Upper/lower flammability or explosive limits**
  - no data available

- **k) Vapour pressure**
  - no data available

- **l) Vapour density**
  - no data available

- **m) Relative density**
  - no data available

- **n) Water solubility**
  - insoluble

- **o) Partition coefficient: n-octanol/water**
  - log Pow: 3.66

- **p) Auto-ignition temperature**
  - no data available

- **q) Decomposition temperature**
  - no data available

- **r) Viscosity**
  - no data available

- **s) Explosive properties**
  - no data available

- **t) Oxidizing properties**
  - no data available

#### 9.2 Other safety information

- no data available

### 10. STABILITY AND REACTIVITY

#### 10.1 Reactivity

- no data available
10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 18.0 mg/kg
Inhalation: no data available
Dermal: no data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: RB91500000
Cholinesterase inhibitors can cause heavy salivation and secretion in the lungs, lachrymation, blurred vision, involuntary defecation, diarrhea, tremor, ataxia, sweating, hypothermia, lowered heart rate, and/or a fall in blood pressure as a result of their action at cholinergic nerve sites., Headache, Nausea, Vomiting, Dizziness, Drowsiness, Confusion., Weakness, Muscle cramps/spasms., Change in pupil size., Fever, Seizures., Incoordination., Convulsions, Coma.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
- LC50 - Carassius auratus (goldfish) - > 0.01 - < 0.1 mg/l - 48.0 h
- LC50 - Leuciscus idus (Golden orfe) - > 0.01 - < 0.1 mg/l - 48.0 h
- LC50 - other fish - > 0.001 - < 0.01 mg/l - 48.0 h

Toxicity to daphnia and other aquatic invertebrates
- EC50 - Daphnia magna (Water flea) - 0.76 mg/l - 48 h
- LC50 - Daphnia magna (Water flea) - > 0.1 - < 1 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
- UN number: 2811  Class: 6.1  Packing group: II
- Proper shipping name: Toxic solids, organic, n.o.s. (Endosulfan sulfate)
- Reportable Quantity (RQ): 1 lbs
- Marine pollutant: No
- Poison Inhalation Hazard: No

IMDG
- UN number: 2811  Class: 6.1  Packing group: II  EMS-No: F-A, S-A
- Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Endosulfan sulfate)
- Marine pollutant: No

IATA
- UN number: 2811  Class: 6.1  Packing group: II
- Proper shipping name: Toxic solid, organic, n.o.s. (Endosulfan sulfate)
15. REGULATORY INFORMATION

**SARA 302 Components**
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Acute Health Hazard

**Massachusetts Right To Know Components**

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1031-07-8</td>
<td>1993-04-24</td>
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</table>

**Pennsylvania Right To Know Components**

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<th>CAS-No.</th>
<th>Revision Date</th>
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<tbody>
<tr>
<td>1031-07-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
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<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1031-07-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- **Acute Tox.**
  - Acute toxicity
- **Aquatic Acute**
  - Acute aquatic toxicity
- **Aquatic Chronic**
  - Chronic aquatic toxicity
- **H300**
  - Fatal if swallowed.
- **H400**
  - Very toxic to aquatic life.
- **H410**
  - Very toxic to aquatic life with long lasting effects.

**HMIS Rating**
- Health hazard: 3
- Chronic Health Hazard: *
- Flammability: 0
- Physical Hazard: 0

**NFPA Rating**
- Health hazard: 3
- Fire Hazard: 0
- Reactivity Hazard: 0

Further information
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1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Ethyl Alcohol, pure

Product Number: 459836
Brand: Sigma-Aldrich
Index-No.: 603-002-00-5

CAS-No.: 64-17-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Eye irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H225: Highly flammable liquid and vapour.
H319: Causes serious eye irritation.

Precautionary statement(s)
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.
P264: Wash skin thoroughly after handling.
P280: Wear protective gloves/ eye protection/ face protection.
P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminated clothing.
Rinse skin with water/shower.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P235 Store in a well-ventilated place. Keep cool.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms: Absolute alcohol

Formula: \( \text{C}_2\text{H}_6\text{O} \)
Molecular weight: 46.07 g/mol
CAS-No.: 64-17-5
EC-No.: 200-578-6
Index-No.: 603-002-00-5

Hazardous components

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<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
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</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>Flam. Liq. 2; Eye Irrit. 2A; H225, H319</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
5.3 **Advice for firefighters**
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 **Further information**
Use water spray to cool unopened containers.

6. **ACCIDENTAL RELEASE MEASURES**

6.1 **Personal precautions, protective equipment and emergency procedures**
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 **Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 **Methods and materials for containment and cleaning up**
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 **Reference to other sections**
For disposal see section 13.

7. **HANDLING AND STORAGE**

7.1 **Precautions for safe handling**
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition. No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 **Conditions for safe storage, including any incompatibilities**
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Hygroscopic.
Storage class (TRGS 510): Flammable liquids

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. **EXPOSURE CONTROLS/PERSONAL PROTECTION**

8.1 **Control parameters**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
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<tbody>
<tr>
<td>Ethanol</td>
<td>64-17-5</td>
<td>TWA</td>
<td>1,000.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td>Confirmed animal carcinogen with unknown relevance to humans</td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>1,000 ppm</td>
<td>1,900 mg/m³</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>1,000 ppm</td>
<td>1,900 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>The value in mg/m³ is approximate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>1,000.000000 ppm</td>
<td>1,900.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>The value in mg/m³ is approximate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

- **Eye/face protection**
  Face shield and safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU).

- **Skin protection**
  Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

  Full contact
  Material: butyl-rubber
  Minimum layer thickness: 0.3 mm
  Break through time: 480 min
  Material tested: Butoject® (KCL 897 / Aldrich Z677647, Size M)

- **Splash contact**
  Material: Nitrile rubber
  Minimum layer thickness: 0.2 mm
  Break through time: 38 min
  Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

  data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

  If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

- **Body Protection**
  Impervious clothing, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

- **Respiratory protection**
  Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) **Appearance**
   Form: liquid, clear
   Colour: colourless

b) **Odour**
   No data available

---

USA. NIOSH Recommended Exposure Limits

<table>
<thead>
<tr>
<th>TWA</th>
<th>USA. ACGIH Threshold Limit Values (TLV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000.000000 ppm</td>
<td>1,900.000000 mg/m3</td>
</tr>
</tbody>
</table>

Upper Respiratory Tract irritation
Confirmed animal carcinogen with unknown relevance to humans
c) Odour Threshold No data available

d) pH No data available


e) Melting point/freezing point Melting point/range: -114 °C (-173 °F)

f) Initial boiling point and boiling range 78 °C (172 °F)

g) Flash point 14.0 °C (57.2 °F) - closed cup

h) Evaporation rate No data available

i) Flammability (solid, gas) No data available

j) Upper/lower flammability or explosive limits Upper explosion limit: 19 % (V)

k) Vapour pressure 59.5 hPa (44.6 mmHg) at 20.0 °C (68.0 °F)

l) Vapour density No data available

m) Relative density 0.789 g/mL at 25 °C (77 °F)

n) Water solubility completely soluble

o) Partition coefficient: n-octanol/water log Pow: -0.349 at 24 °C (75 °F)

p) Auto-ignition temperature 363.0 °C (685.4 °F)

q) Decomposition temperature No data available

r) Viscosity No data available

s) Explosive properties No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Alkali metals, Oxidizing agents, Peroxides

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 10,470 mg/kg
LC50 Inhalation - Rat - 4 h - 30,000 mg/l
LD50 Dermal - Rabbit - 15,800 mg/kg

No data available

**Skin corrosion/irritation**

Skin - Rabbit
Result: No skin irritation - 24 h
(OECD Test Guideline 404)

**Serious eye damage/eye irritation**

Eyes - Rabbit
Result: Moderate eye irritation
(OECD Test Guideline 405)

**Respiratory or skin sensitisation**

No data available

**Germ cell mutagenicity**

No data available

**Carcinogenicity**

Carcinogenicity - Mouse - Oral

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**

No data available

Reproductive toxicity - Human - female - Oral
Effects on Newborn: Apgar score (human only). Effects on Newborn: Other neonatal measures or effects. Effects on Newborn: Drug dependence.

**Specific target organ toxicity - single exposure**

No data available

**Specific target organ toxicity - repeated exposure**

No data available

**Aspiration hazard**

No data available

**Additional Information**

RTECS: KQ6300000

Central nervous system depression, narcosis, Damage to the heart., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

---

12. ECOLOGICAL INFORMATION

12.1 Toxicity

**Toxicity to fish**

LC50 - Pimephales promelas (fathead minnow) - 14,200 mg/l - 96 h

**Toxicity to daphnia and other aquatic invertebrates**

LC50 - Ceriodaphnia dubia (water flea) - 5,012 mg/l - 48 h
NOEC - Daphnia magna (Water flea) - 9.6 mg/l - 9 d
Toxicity to algae EC50 - Chlorella vulgaris (Fresh water algae) - 275 mg/l - 72 h
(OECD Test Guideline 201)

12.2 Persistence and degradability
Biodegradability Result: 95 % - Readily biodegradable

12.3 Bioaccumulative potential
Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1170 Class: 3 Packing group: II
Proper shipping name: Ethanol Reportable Quantity (RQ):

Poison Inhalation Hazard: No

IMDG
UN number: 1170 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: ETHANOL

IATA
UN number: 1170 Class: 3 Packing group: II
Proper shipping name: Ethanol

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components
Ethanol CAS-No. 64-17-5 Revision Date 2007-03-01

Pennsylvania Right To Know Components
CAS-No. Revision Date
Ethanol 64-17-5 2007-03-01

New Jersey Right To Know Components

Ethanol 64-17-5 2007-03-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit. Eye irritation
Flam. Liq. Flammable liquids
H225 Highly flammable liquid and vapour.
H319 Causes serious eye irritation.

HMIS Rating
Health hazard: 2
Chronic Health Hazard: *
Flammability: 3
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0

Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 07/09/2015 Print Date: 02/23/2016
Safety Data Sheet

Material Name: ETHYL BENZENE

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name
ETHYL BENZENE

Synonyms
MTG MSDS 185; EB; PHENYLETHANE; ETHYLBENZENE; ETHYLBENZOL; ALPHA-METHYLTOLUENE; UN 1175; C8H10

Chemical Family
Hydrocarbons, aromatic

Product Use
Industrial.

Restrictions on Use
None known.

Details of the supplier of the safety data sheet
MATHESON TRI-GAS, INC.
150 Allen Road, Suite 302
Basking Ridge, NJ 07920
General Information: 1-800-416-2505
Emergency #: 1-800-424-9300 (CHEMTREC)
Outside the US: 703-527-3887 (Call collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.
Flammable Liquids - Category 2
Aspiration Hazard - Category 1
Acute Toxicity - Inhalation - Dust/Mist - Category 4
Acute Toxicity - Inhalation - Vapor - Category 4
Skin Corrosion/Irritation - Category 2
Serious Eye Damage/Eye Irritation - Category 2A
Carcinogenicity - Category 2
Reproductive Toxicity - Category 1B
Specific target organ toxicity - Single exposure - Category 2
Specific target organ toxicity - Single exposure - Category 3
Specific Target Organ Toxicity - Repeated Exposure - Category 2 (ears, Ears)
Hazardous to the Aquatic Environment - Acute - Category 2
Hazardous to the Aquatic Environment - Chronic - Category 2

GHS Label Elements

Symbol(s)

Signal Word
Danger

Hazard Statement(s)
Safety Data Sheet

Material Name: ETHYL BENZENE

Highly flammable liquid and vapor.
Harmful if inhaled.
Causes skin irritation.
Causes serious eye irritation.
Suspected of causing cancer.
May damage fertility or the unborn child.
May cause damage to organs. (central nervous system )
May cause respiratory irritation.
May be fatal if swallowed and enters airways.
Toxic to aquatic life.

Precautionary Statement(s)

Prevention
Keep away from heat, sparks, open flame, and hot surfaces - No smoking.
Keep container tightly closed.
Ground/Bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Use Personal Protective equipment as required.
Do not breathe vapor or mist.
Use only outdoors or in a well-ventilated area.
Wear protective gloves and eye/face protection.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Avoid release to the environment.

Response
In case of fire, use media appropriate for extinction.
If exposed or concerned: Get medical advice/attention.
If INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or doctor/physician if you feel unwell.
If ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
If skin irritation occurs: Get medical advice/attention.
Wash contaminated clothing before reuse.
If IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
If eye irritation persists: Get medical advice/attention.
If SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
Do NOT induce vomiting.

Storage
Store in a well-ventilated place.
Keep cool.
Keep container tightly closed.
Store locked up.

Disposal
Dispose in accordance with all applicable regulations.

Statement(s) of Unknown Acute Toxicity
Inhalation 0% of the mixture consists of ingredient(s) of unknown acute toxicity.
Safety Data Sheet

Material Name: ETHYL BENZENE

SDS ID: MAT08780

Statement(s) of Unknown Aquatic Toxicity
0% of the mixture consists of ingredient(s) of unknown acute aquatic toxicity.
0% of the mixture consists of ingredient(s) of unknown chronic aquatic toxicity.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CAS</th>
<th>Component Name</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-41-4</td>
<td>ETHYL BENZENE</td>
<td>100</td>
</tr>
</tbody>
</table>

Section 4 - FIRST AID MEASURES

Inhalation
If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin
Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Eyes
Flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

Ingestion
aspiration hazard. Do NOT induce vomiting. When vomiting occurs, keep head lower than hips to help prevent aspiration. Get medical attention immediately. Give artificial respiration if not breathing.

Most Important Symptoms/Effects
Acute
respiratory tract irritation, skin irritation, eye irritation, central nervous system damage, lung damage (from aspiration)

Delayed
cancer, Reproductive Effects

Note to Physicians
For inhalation, consider oxygen.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media
Suitable Extinguishing Media
regular dry chemical, carbon dioxide, water spray, regular foam, Large fires: Use water spray, fog or regular foam.

Unsuitable Extinguishing Media
Do not use high-pressure water streams.

Special Hazards Arising from the Chemical
Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

Hazardous Combustion Products
Oxides of carbon

Fire Fighting Measures
Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank,
rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

**Special Protective Equipment and Precautions for Firefighters**
Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

## Section 6 - ACCIDENTAL RELEASE MEASURES

### Personal Precautions, Protective Equipment and Emergency Procedures
Wear personal protective clothing and equipment, see Section 8.

### Methods and Materials for Containment and Cleaning Up
Avoid heat, flames, sparks and other sources of ignition. Eliminate all ignition sources if safe to do so. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if possible without personal risk. Prevent entry into waterways, sewers, basements, or confined areas. Reduce vapors with water spray. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Dike for later disposal. Remove sources of ignition. Use water spray to reduce vapors or divert vapor cloud drift. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

### Environmental Precautions
Avoid release to the environment.

## Section 7 - HANDLING AND STORAGE

### Precautions for Safe Handling
Keep away from heat, sparks, open flame, and hot surfaces - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharges. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use Personal Protective equipment as required. Do not breathe vapor or mist. Use only outdoors or in a well-ventilated area. Wear protective gloves/eye protection/face protection. Wash hands thoroughly after handling. Do not eat, drink, or smoke when using this product. Avoid release to the environment.

### Conditions for Safe Storage, Including any Incompatibilities

### Incompatible Materials
Acids, bases, oxidizing materials, combustible materials

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### Component Exposure Limits

| ETHYL BENZENE | 100-41-4 |

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**Issue date:** 2017-09-20  **Revision:** 3.17  **Print date:** 2017-09-20
# Safety Data Sheet

**Material Name:** ETHYL BENZENE  
**SDS ID:** MAT08780

<table>
<thead>
<tr>
<th>Source</th>
<th>Threshold Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH</td>
<td>20 ppm TWA</td>
</tr>
<tr>
<td>NIOSH</td>
<td>100 ppm TWA ; 435 mg/m³ TWA</td>
</tr>
<tr>
<td></td>
<td>125 ppm STEL ; 545 mg/m³ STEL</td>
</tr>
<tr>
<td></td>
<td>800 ppm IDLH (10% LEL)</td>
</tr>
<tr>
<td>Europe</td>
<td>100 ppm TWA ; 442 mg/m³ TWA</td>
</tr>
<tr>
<td></td>
<td>Possibility of significant uptake through the skin</td>
</tr>
<tr>
<td>OSHA (US)</td>
<td>200 ppm STEL ; 884 mg/m³ STEL</td>
</tr>
<tr>
<td>Mexico</td>
<td>100 ppm TWA ; 435 mg/m³ TWA</td>
</tr>
<tr>
<td></td>
<td>125 ppm STEL [PPT-CT ]; 545 mg/m³ STEL [PPT-CT ]</td>
</tr>
</tbody>
</table>

**ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)**

ETHYL BENZENE (100-41-4)

0.15 g/g creatinine Medium: urine  
Time: end of shift  
Parameter: Sum of mandelic acid and phenylglyoxylic acid (nonspecific)

**Engineering Controls**

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Individual Protection Measures, such as Personal Protective Equipment**

**Eye/face protection**

Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

**Skin Protection**

Wear appropriate chemical resistant clothing.

**Respiratory Protection**

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. 800 ppm. Any air-purifying half-mask respirator equipped with organic vapor cartridge(s). Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any powered, air-purifying respirator with organic vapor cartridge(s). Any supplied-air respirator. Any self-contained breathing apparatus with a full facepiece. Emergency or planned entry into unknown concentrations or IDLH conditions. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Escape - Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**Glove Recommendations**

Wear appropriate chemical resistant gloves.
### Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Clear, colorless liquid</th>
<th>Physical State</th>
<th>liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>aromatic odor</td>
<td>Color</td>
<td>colorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>140 ppm</td>
<td>pH</td>
<td>Not available</td>
</tr>
<tr>
<td>Melting Point</td>
<td>-95 °C (-139 °F)</td>
<td>Boiling Point</td>
<td>136 °C (277 °F)</td>
</tr>
<tr>
<td>Boiling Point Range</td>
<td>Not available</td>
<td>Freezing point</td>
<td>Not available</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>&lt;1 (Butyl acetate = 1)</td>
<td>Flammability (solid, gas)</td>
<td>Not available</td>
</tr>
<tr>
<td>Autoignition</td>
<td>432 °C (810 °F)</td>
<td>Flash Point</td>
<td>15 °C Closed Cup (59 °F)</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>Decomposition temperature</td>
<td>Not available</td>
</tr>
<tr>
<td>Lower Explosive Limit</td>
<td>0.8 %</td>
<td>Vapor Pressure</td>
<td>7.1 mmHg @ 20 °C</td>
</tr>
<tr>
<td>Upper Explosive Limit</td>
<td>6.7 %</td>
<td>Specific Gravity (water=1)</td>
<td>0.867</td>
</tr>
<tr>
<td>Vapor Density (air=1)</td>
<td>3.66</td>
<td>Partition coefficient: n-octanol/water</td>
<td>154170.05</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>0.015 %</td>
<td>Kinematic viscosity</td>
<td>Not available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>0.64 cp</td>
<td>Bioconcentration Factor (BCF)</td>
<td>36.39</td>
</tr>
<tr>
<td>Solubility (Other)</td>
<td>Not available</td>
<td>Henry's Law Constant</td>
<td>0.00788 atm-m3/mole</td>
</tr>
<tr>
<td>Density</td>
<td>Not available</td>
<td>Physical Form</td>
<td>liquid</td>
</tr>
<tr>
<td>KOC</td>
<td>520 (Estimated)</td>
<td>Volatility</td>
<td>100 %</td>
</tr>
<tr>
<td>Solvent Solubility</td>
<td></td>
<td>Molecular Formula</td>
<td>C-H3-C-H2-C6-H5</td>
</tr>
<tr>
<td>Soluble</td>
<td>alcohol, ether, Benzene, sulfur dioxide, carbon tetrachloride</td>
<td>OSHA Flammability Class</td>
<td>1B</td>
</tr>
<tr>
<td>Insoluble</td>
<td>ammonia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Section 10 - STABILITY AND REACTIVITY

**Reactivity**
No reactivity hazard is expected.

**Chemical Stability**
Stable at normal temperatures and pressure.
Safety Data Sheet

Material Name: ETHYL BENZENE

Possibility of Hazardous Reactions
Will not polymerize.

Conditions to Avoid
Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

Incompatible Materials
Acids, bases, oxidizing materials, combustible materials

Hazardous decomposition products
Oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation
irritation (possibly severe), chest pain, difficulty breathing, emotional disturbances, headache, drowsiness, dizziness, loss of coordination, coma, cancer

Skin Contact
irritation

Eye Contact
irritation

Ingestion
nausea, vomiting, stomach pain, aspiration hazard

Acute and Chronic Toxicity

Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and the following selected endpoints are published:

ETHYL BENZENE (100-41-4)
Oral LD50 Rat 3500 mg/kg
Dermal LD50 Rabbit 15400 mg/kg
Inhalation LC50 Rat 17.4 mg/L 4 h

Product Toxicity Data
Acute Toxicity Estimate

<table>
<thead>
<tr>
<th>Route</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermal</td>
<td>&gt; 2000 mg/kg</td>
</tr>
<tr>
<td>Inhalation - Vapor</td>
<td>17.4 mg/L</td>
</tr>
<tr>
<td>Oral</td>
<td>&gt; 2000 mg/kg</td>
</tr>
</tbody>
</table>

Immediate Effects
respiratory tract irritation, skin irritation, eye irritation, central nervous system damage, lung damage (from aspiration)

Delayed Effects
Reproductive Effects, cancer

Irritation/Corrosivity Data
respiratory tract irritation, skin irritation, eye irritation

Respiratory Sensitization
No data available.

Dermal Sensitization
No data available.

Component Carcinogenicity
# Safety Data Sheet

## Material Name: ETHYL BENZENE

<table>
<thead>
<tr>
<th>ETHYL BENZENE</th>
<th>100-41-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH:</td>
<td>A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans</td>
</tr>
<tr>
<td>IARC:</td>
<td>Monograph 77 [2000] (Group 2B (possibly carcinogenic to humans))</td>
</tr>
<tr>
<td>DFG:</td>
<td>Category 4 (no significant contribution to human cancer)</td>
</tr>
<tr>
<td>OSHA:</td>
<td>Present</td>
</tr>
</tbody>
</table>

**Germ Cell Mutagenicity**  
No data available.

**Tumorigenic Data**  
No data available

**Reproductive Toxicity**  
Available data characterizes components of this product as reproductive hazards.

**Specific Target Organ Toxicity - Single Exposure**  
central nervous system, Respiratory system

**Specific Target Organ Toxicity - Repeated Exposure**  
No target organs identified.

**Aspiration hazard**  
This material is an aspiration hazard.

**Medical Conditions Aggravated by Exposure**  
kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies

**Additional Data**  
May cross the placenta.

## Section 12 - ECOLOGICAL INFORMATION

**Ecotoxicity**  
Toxic to aquatic life.

**Component Analysis - Aquatic Toxicity**

<table>
<thead>
<tr>
<th>ETHYL BENZENE</th>
<th>100-41-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish:</td>
<td>LC50 96 h Oncorhynchus mykiss 11 - 18 mg/L [static ]; LC50 96 h Oncorhynchus mykiss 4.2 mg/L [semi-static ]; LC50 96 h Pimephales promelas 7.55 - 11 mg/L [flow-through ]; LC50 96 h Lepomis macrochirus 32 mg/L [static ]; LC50 96 h Pimephales promelas 9.1 - 15.6 mg/L [static ]; LC50 96 h Poecilia reticulata 9.6 mg/L [static ]</td>
</tr>
<tr>
<td>Algae:</td>
<td>EC50 72 h Pseudokirchneriella subcapitata 4.6 mg/L IUCLID ; EC50 96 h Pseudokirchneriella subcapitata &gt;438 mg/L IUCLID ; EC50 72 h Pseudokirchneriella subcapitata 2.6 - 11.3 mg/L [static ] EPA ; EC50 96 h Pseudokirchneriella subcapitata 1.7 - 7.6 mg/L [static ] EPA</td>
</tr>
<tr>
<td>Invertebrate:</td>
<td>EC50 48 h Daphnia magna 1.8 - 2.4 mg/L IUCLID</td>
</tr>
</tbody>
</table>

**Persistence and Degradability**  
Not expected to undergo hydrolysis in the environment.

**Bioaccumulative Potential**  
Bioconcentration potential in aquatic organisms is low based on a BCF value of 15.

**Mobility**

---

**Issue date:** 2017-09-20  **Revision:** 3.17  **Print date:** 2017-09-20
Safety Data Sheet

Material Name: ETHYL BENZENE

Expected to have moderate mobility in soil.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262.

Hazardous Waste Number(s): D001.

Component Waste Numbers
The U.S. EPA has not published waste numbers for this product's components.

Section 14 - TRANSPORT INFORMATION

US DOT Information:
Shipping Name: ETHYLBENZENE
Hazard Class: 3
UN/NA #: UN1175
Packing Group: II
Required Label(s): 3
Marine pollutant

IMDG Information:
Shipping Name: ETHYLBENZENE
Hazard Class: 3
UN#: UN1175
Packing Group: II
Required Label(s): 3
Marine pollutant

International Bulk Chemical Code
This material contains one or more of the following chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

<table>
<thead>
<tr>
<th>ETHYL BENZENE</th>
<th>100-41-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBC Code:</td>
<td>Category Y</td>
</tr>
</tbody>
</table>

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations
This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

<table>
<thead>
<tr>
<th>ETHYL BENZENE</th>
<th>100-41-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARA 313:</td>
<td>0.1 % de minimis concentration</td>
</tr>
<tr>
<td>CERCLA:</td>
<td>1000 lb final RQ ; 454 kg final RQ</td>
</tr>
</tbody>
</table>

SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories
Flammable; Carcinogenicity; Acute toxicity; Reproductive Toxicity; Skin Corrosion/Irritation; Serious Eye Damage/Eye Irritation; Specific Target Organ Toxicity; Aspiration Hazard

U.S. State Regulations
The following components appear on one or more of the following state hazardous substances lists:
Safety Data Sheet

Material Name: ETHYL BENZENE  
SDS ID: MAT08780

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>CA</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETHYL BENZENE</td>
<td>100-41-4</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):
WARNING! This product contains a chemical known to the state of California to cause cancer

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>CA</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETHYL BENZENE</td>
<td>100-41-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carc:</td>
<td>carcinogen , 6/11/2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Canada Regulations

Canadian WHMIS Ingredient Disclosure List (IDL)
Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>CA</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETHYL BENZENE</td>
<td>100-41-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHMIS Classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Component Analysis - Inventory

ETHYL BENZENE (100-41-4)

|----|----|----|----|----|----------|------------|--------------------|--------------------|-----------------|----|----|----|----|-----------------|
| Yes| DSL| EIN| Yes| Yes| Yes      | Yes        | No                 | No                 | Yes             | Yes| Yes| Yes| Yes| Yes

Section 16 - OTHER INFORMATION

NFPA Ratings
Health: 2 Fire: 3 Reactivity: 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes
Updated: 05/01/2015

Key / Legend
ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research;
Safety Data Sheet

Material Name: ETHYL BENZENE

on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL -
Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime
Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical
Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing
Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing
Chemicals Inventory (KECI)/ Korea Existing Chemicals List (KECL), KR - Korea; LD50/LC50 - Lethal Dose/
Lethal Concentration; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ -
ChemADVISOR’s Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL -
Maximum Exposure Limits; MX – Mexico; NDSL – Non-Domestic Substance List (Canada); NFPA - National Fire
Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade
Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health
Administration; PEL- Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery
Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport;
SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TCCA – Korea
Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA -
Toxic Substances Control Act; TW – Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit;
UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); VN NCI
(Draft) - Vietnam National Chemicals Inventory (NCI) (Draft); WHMIS - Workplace Hazardous Materials
Information System (Canada).

Other Information

Disclaimer:
Matheson Tri-Gas, Inc. makes no express or implied warranties, guarantees or representations regarding the product
or the information herein, including but not limited to any implied warranty or merchantability or fitness for use.
Matheson Tri-Gas, Inc. shall not be liable for any personal injury, property or other damages of any nature, whether
compensatory, consequential, exemplary, or otherwise, resulting from any publication, use or reliance upon the
information herein.
1. PRODUCT IDENTIFICATION

2. COMPOSITION and INFORMATION ON INGREDIENTS

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A potential health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

CONCENTRATION OF HYDROGEN SULFIDE

OBSERVED EFFECT
0-30 ppm Odor is unpleasant.
50 ppm Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm Irritation of the respiratory system.
100-150 ppm Temporary loss of smell.
200-250 ppm Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-6 hours can be fatal.
300-500 Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm Headache, excitation, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.
> 600 ppm Rapid onset of unconsciousness, coma, death.
> 1000 ppm Immediate respiratory arrest.

NOTE: This gas mixture contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.
Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs. Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

**CONCENTRATION OF CARBON MONOXIDE**

<table>
<thead>
<tr>
<th>All exposure levels:</th>
<th>Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 ppm:</td>
<td>Slight symptoms (i.e. headache) after several hours of exposure.</td>
</tr>
<tr>
<td>400 ppm:</td>
<td>Headache and discomfort experienced within 2-3 hours of exposure.</td>
</tr>
<tr>
<td>1,000 -2000 ppm:</td>
<td>Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.</td>
</tr>
<tr>
<td>&gt;2500 ppm:</td>
<td>Potential for collapse and death before warning symptoms.</td>
</tr>
</tbody>
</table>

Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, nausea, unconsciousness, loss of consciousness, vomiting, difficulty in breathing, and loss of the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

**CONCENTRATION OF OXYGEN**

<table>
<thead>
<tr>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-14% Oxygen:</td>
</tr>
<tr>
<td>6-10% Oxygen:</td>
</tr>
</tbody>
</table>

**SKIN and EYE CONTACT:** Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in "gas eyes" or "sore eyes" with symptoms of burning, irritation, tearing, and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms:** Over-exposure to this gas mixture may cause the following health effects:

**ACUTE:** Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under normal circumstances of use. However the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.

**CHRONIC:** Severe over-exposures to the Hydrogen Sulfide component of this gas mixture, which do not result in death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. In serious cases of over-exposure, the eyes can be permanently damaged. Skin disorders and respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

**TARGET ORGANS:** ACUTE: Respiratory system, blood system, central nervous system effects, cardiovascular system, skin, eyes. CHRONIC: Neurological system, reproductive system, eyes.

**4. FIRST-AID MEASURES**

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTION.** Structures, including Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

**SKIN EXPOSURE:** If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

**EYE EXPOSURE:** If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Certain medical conditions may aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this gas mixture.

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or preferably, a compressive chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.

**5. FIRE-FIGHTING MEASURES**

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

| Lower (LEL) | Not applicable. |
| Lower (LEL) | Not applicable. |

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas mixture contains toxic gases. Hydrogen Sulfide and Carbon Monoxide, and presents an health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

**Explosion Sensitivity to Static Discharge:** Not Sensitive.

**Explosion Sensitivity to Mechanical Impact:** Not Sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

**6. ACCIDENTAL RELEASE MEASURES**

**LEAK RESPONSE:** Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture. If a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel. For emergency disposal,
secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area. Allow the gas mixture to dissipate. If necessary, monitor the surrounding air using the portable air monitor. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING AND USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to lethal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide unless the modification is a.major or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C (70°F)). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated from inactive, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING:** Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: **WARNING!** Compressed gases can present significant safety hazards. During cylinder operation, use equipment designed for the gas being used. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the levels of components exceed the exposure limits presented in Section 2 (Composition and Information of Ingredients) and Oxygen levels are below 19.5%, or unknown, during emergency response to a release of this gas mixture. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93, and applicable standards of Canadian Provinces. Oxy gen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134-1986). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:
- Up to 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; gas mask with canister to protect against hydrogen sulfide; or, full-facepiece SAR, or full-facepiece SCBA.
- Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
- Escape: Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA.

NOTE: The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:
- Up to 350 ppm: Supplied Air Respirator (SAR).
- Up to 675 ppm: Supplied Air Respirator (SAR) operated in a continuous flow mode.
- Up to 1200 ppm: Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Respirator (SAR).
- Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.
- Escape: Gas mask with canister to protect against carbon monoxide or escape-type SCBA.

NOTE: End of Service Life Indicator (ESLI) required for gas masks.

NOTE: The IDLH concentration for Carbon Monoxide is 1200 ppm.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee’s feet may be exposed to electrical hazards, use foot protection authorized in the U.S. OSHA Standard (29 CFR 1910.136), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93, and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134-1986). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

9. PHYSICAL AND CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

- **GAS DENSITY** @ 32°F (0°C) and 1 atm: 0.072 lbs/ft³ (1.153 kg/m³)
- **FREEZING/MELTING POINT** @ 10 psig: -345.8°F (-210°C)
- **SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 0.906
- **PH:** Not applicable.
- **SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm:** 0.023
- **MOLECULAR WEIGHT:** 28.01
- **EVAPORATION RATE** (nBuAc = 1): Not applicable.
- **EXPANSION RATIO:** Not applicable.
- **VAPOR PRESSURE** @ 70°F (21.1°C) (psig): Not applicable.
- **SPECIFIC VOLUME (lb/ft³):** 13.8

The following information is for this gas mixture.

- **ODOR THRESHOLD:** 0.13 ppm (Hydrogen Sulfide)
- **APPEARANCE AND COLOR:** This gas mixture is a colorless gas whose has a rotten egg-like odor, due to the presence of Hydrogen Sulfide.
- **HOW TO DETECT THIS SUBSTANCE (warning properties):** Continuous inhalation of low concentrations of this gas mixture may cause olfactory fatigue, due to the presence of Hydrogen Sulfide; so the odor is not a good warning property of a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

**STABILITY:** Normally stable in gaseous state.

**DECOMPOSITION PRODUCTS:** The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the event of a fire.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this gas mixture (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine, perfluorocarbons, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

**HAZARDOUS POLYMIZATION:** Will not occur.

**CONDITION TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.
CARBON MONOXIDE (continued):

LCLo (Inhalation-Rabbit) 4000 ppm 5 minutes
LCLo (Inhalation-Human) 5000 ppm/5 minutes

TCLo (Inhalation-Rabbit) 150 ppm/24 hours: female 1-30 days after conception: Reproductive: Effects on Newborn: behavioral
TCLo (Inhalation-Mouse) 50 ppm/24 hours: female 1-30 days after conception: Reproductive: Specific Developmental Abnormalities: Cardiovascular (coronary artery stenosis; aorta lesions; aortic valve malformations; heart; blood vessels; arteries; arterioles); Eye: conjunctive irritation

Suspected CANCER AGENT:

The components of this gas mixture are not suspected to be, nor suspected to be, cancer-causing agents by these agencies.

ENVIRONMENTAL STABILITY:

Atmospheric Fate: A photochemical model was used to quantify the sensitivity of the tropospheric oxidants ozone (O₃) and OH to changes in methane (CH₄), Carbon Monoxide (CO), and NO emissions and to perturbations in climate and stratospheric chemistry. In most cases, but these trends may be opposed by stratospheric O₃ depletion and climate change.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans.

Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase

Teratogenicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

1.2. ECOCLOGICAL INFORMATION

ENVIRONMENTAL STABILITY:

The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

CARBON MONOXIDE:
Atmospheric Fate: A photochemical model was used to quantify the sensitivity of the tropospheric oxidants ozone (O₃) and OH to changes in methane (CH₄), Carbon Monoxide (CO), and NO emissions and to perturbations in climate and stratospheric chemistry. In most cases, increases in NO emissions will supplant the positive radiative effect in areas where NO and O₃ are influenced by pollution are sufficient to increase O₃. In most regions, NO, CO, and CH₄ emission increases will suppress OH and increased O₃, but these trends may be opposed by stratospheric O₃ depletion and climate change.

HYDROGEN SULFIDE:
Water Solubility: 1 g/242 mL at 20°C. Plant toxicity: Continuous fumigation of plants with 3000 or 3000 ppm Hydrogen Sulfide caused leaf lesions, defoliation, and reduced growth with symptoms include: stunted or inhibited growth; distorted, yellow, or brown leaves; and reduced yield. Hydrogen Sulfide gas was applied to 25 species of green plants for 5 hours, young, rapidly elongating tissues were more sensitive to injury than older tissues. Symptoms included scorching of young shoots and

Suspected CANCER AGENT:

The components of this gas mixture are not reported to cause mutagenic effects in humans.

REPRODUCTIVE TOXICITY INFORMATION:

Listed below is information concerning the effects of this gas mixture on the human reproductive system.

Mutagenicity: The components of this gas mixture are not reported to cause mutagenic effects in humans.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

The components of this gas mixture are not reported to cause mutagenic effects in humans.

Biological Exposure Indices (BEIs): Biological Exposure Indices (BEIs) have been determined for components of this gas mixture, as follows:

CHEMICAL DETERMINANT: Blood: CO, PO, O₂, pH, blood gas, EKG, and other changes

CARBON MONOXIDE:

CHEMICAL DETERMINANT: Blood: PO, pH, blood gas, EKG, and other changes

BEI:

CARBON MONOXIDE (continued):

TIMELAPSE STUDIES:

1. TOXICOLOGICAL INFORMATION

There are no specific toxicology data for Nitrogen. Nitrogen is a single, anhydrous, which acts to displace oxygen in the environment.

METHANE:

There are no specific toxicology data for Methane. Methane is a simple, anhydrous, which acts to displace oxygen in the environment.

CARBON MONOXIDE:

LCLo (Inhalation-Rabbit) 1807 ppm/4 hours
LCLo (Inhalation-Rat) 96 ppm/24 hours/90 days
TCLo (Inhalation-Rat) 1800 ppm/1 hour/14 days
TCLo (Inhalation-Rat) 250 ppm/5 hours/20 days
TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral
TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-30 days after conception: Reproductive: Specific Developmental Abnormalities: Cardiovascular (coronary artery stenosis; aorta lesions; aortic valve malformations; heart; blood vessels; arteries; arterioles)

Suspected CANCER AGENT:

The components of this gas mixture are not reported to cause mutagenic effects in humans.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Benign: A chemical which causes temporary changes in the body that are not expected to cause long-term effects (e.g., symptoms include: skin reddening; diaphoresis; flushes; and mild headache. Symptoms include: vomiting; dizziness; and mild headache.)
leaves, bursal and marginal scorching of older leaves. Mature leaves were unaffected. Seeds exposed to Hydrogen Sulfide gas showed delay in germination. Persistence: Converts to elemental sulfur upon standing in water.

Major Species Threatened: Aquatic and animal life plants may be injured if exposed to 5 ppm in air over 24 hours.

Biodegradation: Microorganisms in soil and water are involved in oxidation-reduction reactions that oxidize hydrogen sulfide to elemental sulfur. Members of the genera Sphagnum, Theliocha, and Thiotrichia function in transition zones between aerobic and anaerobic conditions where both molecular oxygen and hydrogen sulfide are found. Also, some photosynthetic bacteria oxidize hydrogen sulfide to elemental sulfur. Members of the families Chlorobiaceae and Chromatiaceae (purple sulfur bacteria) are obligate aerobes and are phototrophic, and are found in waters with high H2S concentrations. The interactions of these organisms form part of the global sulfur cycle.

Bioconcentration: Does not have bioaccumulation or food chain contamination potential.

NITROGEN: Water Solubility = 2-4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this gas mixture’s effects on aquatic life. The presence of more than a trace of the Carbon Monoxide component of this gas mixture is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture:

<table>
<thead>
<tr>
<th>Species</th>
<th>NO₃⁻ (mg/L)</th>
<th>NH₄⁺ (mg/L)</th>
<th>NO₂⁻ (mg/L)</th>
<th>NOₓ (mg/L)</th>
<th>N₂ (mg/L)</th>
<th>Bioconcentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asellus artemisia</td>
<td>0.011</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>None</td>
</tr>
<tr>
<td>Ephemera</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>None</td>
</tr>
<tr>
<td>F (bluegill)</td>
<td>0.0448</td>
<td>0.0448</td>
<td>0.0448</td>
<td>0.0448</td>
<td>0.0448</td>
<td>None</td>
</tr>
<tr>
<td>F (carp)</td>
<td>0.06-0.25</td>
<td>0.06-0.25</td>
<td>0.06-0.25</td>
<td>0.06-0.25</td>
<td>0.06-0.25</td>
<td>None</td>
</tr>
</tbody>
</table>

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Hydrogen Sulfide*) or the gas component with the next highest concentration next to Nitrogen.

Hazard Class Number and Description: 2.2 (Non-Flammable Gas)

UN Identification Number: UN 1956

Packing Group: Not Applicable

DOT Label(s) Required: Non-Flammable Gas


U.S. DEPARTMENT OF TRANSPORTATION INFORMATION (continued):

- Marine Pollutant: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101).

- Special Shipping Information: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

- Cylinders do not have transportation information on the cylinder itself.

- Transport Canada Transportation of Dangerous Goods Regulations: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada.

EFFECT OF MATERIAL ON PLANTS or ANIMALS:

Hydrogen Sulfide component of this gas mixture:

Hydrogen Sulfide:

- Toxic (goldfish) 24 hours = 4.3 mg/L
- Toxic (goldfish) 24 hours = 4.3 mg/L
- Toxic (sunfish) 1 hour = 4.9 to 5.3 mg/L
- Toxic (goldfish) 200 hours = 5 mg/L
- Toxic (minnows) 24 hours = 5-6 mg/L
- Toxic (trout) 15 minutes = 10 mg/L
- Toxic (goldfish) 24 hours = 25 mg/L
- Toxic (tench) 3 hours = 100 mg/L
- MATC.F (bluegill) 0.0037 mg/L

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This gas mixture is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>SARA 302</th>
<th>SARA 304</th>
<th>SARA 313</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- U.S. SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lb (227 kg)
- U.S. SARA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide = 100 lb (45 kg)

OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the applications of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lb (and so one cylinder of this gas mixture will not be affected by this regulation).

- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen and Oxygen are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater.

NON-FLAMMABLE GAS MIXTURE MSDS - 50018

EFFECTIVE DATE: JUNE 7, 2010

PAGE 5 OF 6
15. REGULATORY INFORMATION (continued)

U.S. STATE REGULATORY INFORMATION:

California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Hydrogen Sulfide, Methane.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):

The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists. WARNING! This gas mixture contains a compound known to the State of California to cause birth defects or other reproductive harm.

ANOTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrupping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900. P-1 "Safe Handling of Compressed Gases in Containers" AV-1 "Safe Handling and Storage of Compressed Gases" "Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519 619/670-0609 Fax on Demand: 1-800/231-1366
# SAFETY DATA SHEET

## Helium

## Section 1. Identification

<table>
<thead>
<tr>
<th>GHS product identifier</th>
<th>:</th>
<th>Helium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical name</td>
<td>:</td>
<td>Helium</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>:</td>
<td>helium (dot); Helium-4; He; α-Helium; UN 1046</td>
</tr>
<tr>
<td>Product use</td>
<td>:</td>
<td>Synthetic/Analytical chemistry.</td>
</tr>
<tr>
<td>Synonym</td>
<td>:</td>
<td>helium (dot); Helium-4; He; α-Helium; UN 1046</td>
</tr>
<tr>
<td>SDS #</td>
<td>:</td>
<td>001025</td>
</tr>
<tr>
<td>Supplier's details</td>
<td>:</td>
<td>Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253</td>
</tr>
<tr>
<td>Emergency telephone number (with hours of operation)</td>
<td>:</td>
<td>1-866-734-3438</td>
</tr>
</tbody>
</table>

## Section 2. Hazards identification

| OSHA/HCS status                  | : | This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200). |
| Classification of the substance or mixture | : | GASES UNDER PRESSURE - Compressed gas |

### GHS label elements

#### Hazard pictograms

| Signal word | : | Warning |
| Hazard statements | : | Contains gas under pressure; may explode if heated. May displace oxygen and cause rapid suffocation. |

### Precautionary statements

#### General

Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.

#### Prevention

Use and store only outdoors or in a well ventilated place.

#### Response

Not applicable.

#### Storage

Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

#### Disposal

Not applicable.

### Hazards not otherwise classified

In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

---

**Date of issue/Date of revision**: 10/15/2014  
**Date of previous issue**: 10/2/2014  
**Version**: 0.02  
**1/11**
Section 3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Substance/mixture</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical name</td>
<td>Helium</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>helium (dot); Helium-4; He; o-Helium; UN 1046</td>
</tr>
</tbody>
</table>

**CAS number/other identifiers**
- CAS number : 7440-59-7
- Product code : 001025

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>%</th>
<th>CAS number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>100</td>
<td>7440-59-7</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

**Description of necessary first aid measures**

**Eye contact**
- Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

**Inhalation**
- Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

**Skin contact**
- Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

**Ingestion**
- As this product is a gas, refer to the inhalation section.

**Most important symptoms/effects, acute and delayed**

**Potential acute health effects**

**Eye contact**
- Contact with rapidly expanding gas may cause burns or frostbite.

**Inhalation**
- No known significant effects or critical hazards.

**Skin contact**
- Contact with rapidly expanding gas may cause burns or frostbite.

**Frostbite**
- Try to warm up the frozen tissues and seek medical attention.

**Ingestion**
- As this product is a gas, refer to the inhalation section.

**Over-exposure signs/symptoms**

**Eye contact**
- No specific data.

**Inhalation**
- No specific data.

**Skin contact**
- No specific data.

**Ingestion**
- No specific data.

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to physician**
- Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

**Date of issue/Date of revision** : 10/15/2014.
**Date of previous issue** : 10/2/2014. **Version** : 0.02
Helium

Section 4. First aid measures

Specific treatments: No specific treatment.
Protection of first-aiders: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media: Use an extinguishing agent suitable for the surrounding fire.
Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical

Hazardous thermal decomposition products: Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Special protective actions for fire-fighters: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders: If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions: Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill: Immediately contact emergency personnel. Stop leak if without risk.
Large spill: Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Date of issue/Date of revision: 10/15/2014. Date of previous issue: 10/2/2014. Version: 0.02 3/11
Section 7. Handling and storage

Precautions for safe handling

Protective measures: Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Advice on general occupational hygiene: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities: Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>Oxygen Depletion [Asphyxiant]</td>
</tr>
</tbody>
</table>

Appropriate engineering controls: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with sideshields.
Section 8. Exposure controls/personal protection

**Hand protection**
Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

**Body protection**
Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Other skin protection**
Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Respiratory protection**
Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical state</strong></td>
<td>Gas. [Compressed gas.]</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>Colorless</td>
</tr>
<tr>
<td><strong>Molecular weight</strong></td>
<td>4 g/mole</td>
</tr>
<tr>
<td><strong>Molecular formula</strong></td>
<td>He</td>
</tr>
<tr>
<td><strong>Boiling/condensation point</strong></td>
<td>-268.9°C (-452°F)</td>
</tr>
<tr>
<td><strong>Melting/freezing point</strong></td>
<td>-272.2°C (-458°F)</td>
</tr>
<tr>
<td><strong>Critical temperature</strong></td>
<td>-267.9°C (-450.2°F)</td>
</tr>
<tr>
<td><strong>Odor</strong></td>
<td>Odorless</td>
</tr>
<tr>
<td><strong>Odor threshold</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Flash point</strong></td>
<td>[Product does not sustain combustion.]</td>
</tr>
<tr>
<td><strong>Burning time</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Burning rate</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Evaporation rate</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Flammability (solid, gas)</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Lower and upper explosive</strong></td>
<td>(flammable) limits</td>
</tr>
<tr>
<td><strong>Vapor pressure</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Vapor density</strong></td>
<td>0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft³ (125 kg/m³)</td>
</tr>
<tr>
<td><strong>Specific Volume (ft³/lb)</strong></td>
<td>96.1538</td>
</tr>
<tr>
<td><strong>Gas Density (lb/ft³)</strong></td>
<td>0.0104</td>
</tr>
<tr>
<td><strong>Relative density</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Solubility</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Solubility in water</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Partition coefficient: n-octanol/water</strong></td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Auto-ignition temperature</strong></td>
<td>Not available</td>
</tr>
<tr>
<td><strong>Decomposition temperature</strong></td>
<td>Not available</td>
</tr>
</tbody>
</table>

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Section 9. Physical and chemical properties

**SADT** : Not available.

**Viscosity** : Not applicable.

Section 10. Stability and reactivity

**Reactivity** : No specific test data related to reactivity available for this product or its ingredients.

**Chemical stability** : The product is stable.

**Possibility of hazardous reactions** : Under normal conditions of storage and use, hazardous reactions will not occur.

**Conditions to avoid** : No specific data.

**Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

**Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

**Information on toxicological effects**

**Acute toxicity**
Not available.

**Irritation/Corrosion**
Not available.

**Sensitization**
Not available.

**Mutagenicity**
Not available.

**Carcinogenicity**
Not available.

**Reproductive toxicity**
Not available.

**Teratogenicity**
Not available.

**Specific target organ toxicity (single exposure)**
Not available.

**Specific target organ toxicity (repeated exposure)**
Not available.

**Aspiration hazard**
Not available.
Section 11. Toxicological information

Information on the likely routes of exposure

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation : No known significant effects or critical hazards.
Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.
Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.
Developmental effects : No known significant effects or critical hazards.
Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.
Section 12. Ecological information

**Bioaccumulative potential**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>LogP_{ow}</th>
<th>BCF</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>0.28</td>
<td>-</td>
<td>low</td>
</tr>
</tbody>
</table>

**Mobility in soil**

Soil/water partition coefficient (K_{OC}) : Not available.

**Other adverse effects** : No known significant effects or critical hazards.

Section 13. Disposal considerations

**Disposal methods** : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

<table>
<thead>
<tr>
<th></th>
<th>DOT</th>
<th>TDG</th>
<th>Mexico</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN number</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
</tr>
<tr>
<td>UN proper shipping name</td>
<td>HELIUM, COMPRESSED</td>
<td>HELIUM, COMPRESSED</td>
<td>HELIUM, COMPRESSED</td>
<td>HELIUM, COMPRESSED</td>
<td>HELIUM, COMPRESSED</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Packing group</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Additional information</td>
<td>Limited quantity Yes.</td>
<td></td>
<td>Explosive Limit and Limited Quantity Index 0.125</td>
<td>-</td>
<td>Passenger and Cargo Aircraft Quantity limitation: 75 kg</td>
</tr>
<tr>
<td></td>
<td>Passenger aircraft Quantity limitation: 75 kg</td>
<td>Passenger Carrying Road or Rail Index 75</td>
<td>-</td>
<td>Cargo Aircraft Only Quantity limitation: 150 kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cargo aircraft Quantity limitation: 150 kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

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Section 14. Transport information

Special precautions for user: Transport within user’s premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory information

U.S. Federal regulations: TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs): Not listed
Clean Air Act Section 602 Class I Substances: Not listed
Clean Air Act Section 602 Class II Substances: Not listed
DEA List I Chemicals (Precursor Chemicals): Not listed
DEA List II Chemicals (Essential Chemicals): Not listed
SARA 302/304
Composition/information on ingredients
No products were found.

SARA 304 RQ: Not applicable.
SARA 311/312 Classification: Sudden release of pressure

Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>100</td>
<td>No.</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
</tbody>
</table>

State regulations:

Massachusetts: This material is listed.
New York: This material is not listed.
New Jersey: This material is listed.
Pennsylvania: This material is listed.
Canada inventory: This material is listed or exempted.

International regulations:

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### Section 15. Regulatory information

**International lists**

- **Australia inventory (AICS):** This material is listed or exempted.
- **China inventory (IECSC):** This material is listed or exempted.
- **Japan inventory:** Not determined.
- **Korea inventory:** This material is listed or exempted.
- **Malaysia Inventory (EHS Register):** Not determined.
- **New Zealand Inventory of Chemicals (NZIoC):** This material is listed or exempted.
- **Philippines inventory (PICCS):** This material is listed or exempted.
- **Taiwan inventory (CSNN):** Not determined.

**Chemical Weapons Convention List Schedule I Chemicals:** Not listed

**Chemical Weapons Convention List Schedule II Chemicals:** Not listed

**Chemical Weapons Convention List Schedule III Chemicals:** Not listed

**Canada**

- **WHMIS (Canada):** Class A: Compressed gas.
  - **CEPA Toxic substances:** This material is not listed.
  - **Canadian ARET:** This material is not listed.
  - **Canadian NPRI:** This material is not listed.
  - **Alberta Designated Substances:** This material is not listed.
  - **Ontario Designated Substances:** This material is not listed.
  - **Quebec Designated Substances:** This material is not listed.

### Section 16. Other information

**Canada Label requirements:** Class A: Compressed gas.

**Hazardous Material Information System (U.S.A.)**

- **Health:** 0
- **Flammability:** 0
- **Physical hazards:** 0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

**National Fire Protection Association (U.S.A.)**

- **Health:** 0
- **Flammability:** 0
- **Instability/Reactivity:** 0
- **Special:**

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Section 16. Other information

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

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Date of previous issue : 10/2/2014.
Version : 0.02

Key to abbreviations

ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
UN = United Nations
ACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References

Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.
SECTION I: MATERIAL IDENTIFICATION

IDENTITY: Potassium hydrogen phthalate
P/N 350623, 527033, 696138-1, 9003001600, 100-4

CHEMICAL FORMULA: \( C_6H_4/(COOK)/(COOH) \sim 1\% \) in water

GENERIC NAME: pH 4 Buffer Solution

CHEMICAL FAMILY: Salt solution

OTHER DESIGNATION: pH 4 Standard Solution, Autocal solution, 100-4

IN CASE OF EMERGENCY CONTACT YOUR REGIONAL PLANT MANAGER

SECTION II: HAZARDOUS INGREDIENTS

Irritant: Eyes, nose and throat, skin.

This product contains the following toxic chemical(s) subject to Section 313 Title III reporting requirements (40 CFR Part 372): NONE

SECTION III: PHYSICAL DATA

MELTING POINT (\(^\circ\)C): 295-300 SPECIFIC GRAVITY (\(H_2O = 1\)): 1.636

VAPOR PRESSURE: N/A PERCENT, VOLATILE BY VOLUME (%): None

SOLUBILITY IN WATER v/v \(^\circ\)C: 1.2% (cool water) CAS #: 877-24-7

APPEARANCE AND ODOR: Colorless liquid

SECTION IV: PHYSICAL DATA

FLASH POINT AND METHOD: N/A

FLAMMABLE LIMITS: None

EXTINGUISHING MEDIA: Determine based on surrounding combustibles.

SPECIAL FIRE FIGHTING PROCEDURES: None

UNUSUAL FIRE AND EXPLOSION HAZARDS: N/A

SECTION V: REACTIVITY DATA

STABILITY: Stable at normal temperature

INCOMPATIBILITY (MATERIALS TO AVOID): None

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION: None
SECTION VI: HEALTH HAZARD DATA

EMERGENCY AND FIRST AID PROCEDURES:

Eyes: Wash eyes with clean water flowing for 10-15 minutes. Call doctor immediately.
Skin: Take off contaminated clothing and wash skin with water.
Inhaled: Move the patient into clear air. Keep patient warm and stable. Loosen clothing and use artificial respiration if necessary. Call doctor immediately.
Swallowed: Give patient plenty of warm water/milk. Induce vomiting. Call doctor immediately. If patient is unconscious, do not give water/milk, but call doctor immediately.

SECTION VII: SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Collect as much material as possible. The place of leakage should be washed with plenty of water.

WASTE DISPOSAL METHOD:
Dispose as chemical waste.

SECTION VIII: SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Not normally required.
VENTILATION: Not normally required.
OTHER PROTECTIVE EQUIPMENT: Optional - eye mask, gloves and long-sleeve working clothes.

SECTION IX: SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
After working, wash hands thoroughly.

OTHER PRECAUTIONS: None.
MATERIAL SAFETY DATA SHEET

1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS:** Nonflammable Gas Mixture

Containing one or more of the following components in a nitrogen balance gas:

- **Oxygen:** 0-23.5%; Isobutylene, 0.0005-0.9%

**SYNONYMS:** Not Applicable

**CHEMICAL FAMILY NAME:** Not Applicable

**FORMULA:** Not Applicable

**Document Number:** 50054

**Note:** The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT-39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

**PRODUCT USE:**

Calibration of Monitoring and Research Equipment

**SUPPLIER/MANUFACTURER’S NAME:** CALGAZ

**ADDRESS:**

821 Chésapeake Drive

Cambridge, MD 21613

**EMERGENCY PHONE:** CHEMTREC: 1-800-424-9300

1-410-228-6400

**BUSINESS PHONE:**

General MSDS Information: 1-713/868-0440

Fax on Demand: 1-800/231-1366

**2. COMPOSITION and INFORMATION ON INGREDIENTS**

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACGIH-TLV ppm</td>
</tr>
<tr>
<td>Isobutylene</td>
<td>115-11-7</td>
<td>0.0005-0.9%</td>
<td>There are no specific exposure limits for Isobutylene.</td>
</tr>
<tr>
<td>Oxygen</td>
<td>7782-44-7</td>
<td>0-23.5%</td>
<td>There are no specific exposure limits for Oxygen.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>Balance</td>
<td>There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.</td>
</tr>
</tbody>
</table>

**NOTE (1):** All WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

**3. HAZARD IDENTIFICATION**

**EMERGENCY OVERVIEW:** This is a colorless, odorless gas mixture. Releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:** The most significant health effect from over-exposure for this gas mixture is by inhalation.

**INHALATION:** Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

**CONCENTRATION OF OXYGEN**

**OBSERVED EFFECT**

- 12-16% Oxygen: Breathing and pulse rate increase, muscular coordination slightly disturbed.
- 10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.
- 6-10% Oxygen: Nausea, vomiting, collapse, or loss of consciousness. Below 6%: Convulsive movements, possible respiratory collapse, and death.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:** An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

**ACUTE:** Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this gas mixture when it contains less than 19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. Additionally, Isobutylene, a component of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

**CHRONIC:** Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

**TARGET ORGANS:** ACUTE: Respiratory system, eyes. CHRONIC: Heart, cardiovascular system, central nervous system.
4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms and eliminate exposure.

5. FIRE-FIGHTING MEASURES

FLASHPOINT: Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS (in air by volume, %):

| LEL | Not applicable. |
| UEL | Not applicable. |

FLAMMABILITY:

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>FLAMMABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.</td>
<td></td>
</tr>
</tbody>
</table>

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

EXPLOSION SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.
EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, further ventilation may be required. In areas where this gas mixture is likely to be used, local exhaust ventilation should be provided.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Maintain oxygen levels above 19.5% in the workplace. Use supplied air respirator protection when oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of Methane and Oxygen. If respiratory protection is needed, use the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z444-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134).


HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or equivalent Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, or where employee’s feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.138.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lb/ft³ (1.153 kg/m³)

BOILING POINT: -195.8°C (-320.4°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.96

SUDDEN LIQUIDITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 1.02

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

The following information is for Oxygen, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.083 lb/ft³ (1.326 kg/m³)

FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F)

PH: Not applicable.
MOLECULAR WEIGHT: 32.00
EXPANSION RATIO: Not applicable.
SPECIFIC VOLUME (ft³/lb): 13.8

The following information is for Oxygen, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 1.105

BOILING POINT: -183.0°C (-297.4°F)

PH: Not applicable.
MOLECULAR WEIGHT: 32.00
EXPANSION RATIO: Not applicable.
VOLUME (ft³/lb): 12.1

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the gas mixture.
APPEARANCE AND COLOR: This is a colorless, odorless gas mixture.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

NON-FLAMMABLE GAS MIXTURE MSDS - 50054
EFFECTIVE DATE: MAY 5, 2008

PAGE 2 OF 4
10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, gas, but can react with other compounds in the presence of strong oxidizers such as chlorine, bromine, pentachlorofluoride, oxygen difluoride, and oxygen trifluoride.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in the Nitrogen component of this gas mixture. Lithium reacts slowly with Nitrogen at ambient temperatures. The Isobutylene component of this gas mixture is also incompatible with strong oxidizers (i.e., chlorine, bromine, pentachlorofluoride, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicity data are available for the components of this gas mixture:

ISOBUTYLENE:
LC50 (inhalation, rat) = 620,000 mg/kg/4 hours
LC50 (inhalation, mouse) = 415,000 mg/kg

NITROGEN:
There are no specific toxicity data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

IRRITANCY OF PRODUCT:
Contact with rapidly expanding gases can be irritating to exposed skin and eyes.

SENSITIZATION TO THE PRODUCT:
The components of this gas mixture are not known to cause human skin or respiratory sensitization.

REPRODUCTIVE TOXICITY INFORMATION:
Listing below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components in this gas mixture.
Embryotoxicity: No embryotoxic effects have been described for the components in this gas mixture.
Teratogenicity: No teratogenically effects have been described for the components in this gas mixture.
Reproductive Toxicity: No reproductive toxicity effects have been described for the components in this gas mixture.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embroyotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

Mutagenicity: No mutagenicity effects have been described for the components in this gas mixture.
Embryotoxicity: No embryotoxic effects have been described for the components in this gas mixture.
Teratogenicity: No teratogenically effects have been described for the components in this gas mixture.
Reproductive Toxicity: No reproductive toxicity effects have been described for the components in this gas mixture.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embroyotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

BIOLICAL EXPOSURE INDICES (BEIs):
Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY:
The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture:

OXYGEN:
Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log Kow = -0.65

NITROGEN:
Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS OR ANIMALS: No evidence is currently available on the effects of this gas mixture on plant and animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas mixture on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with applicable Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen*) for the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126
MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen*) for the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not Applicable
HAZARD LABEL: Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12
ERAP INDEX: None
PAASSENGER CARRYING SHIP INDEX: None
PAASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126
NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:
U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.
U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this gas mixture. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.
U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.
OTHER U.S. FEDERAL REGULATIONS:
- No component of this gas mixture is subject to the requirements of CFR 29 1910.100 (under the 1989 PELs).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).
• Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,554 kg) or greater.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

- Alaska - Designated Toxic and Hazardous Substances: No.
- California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen.
- Florida - Substance List: Oxygen, Isobutylene.
- Illinois - Toxic Substance List: No.
- Kansas - Section 302/313 List: No.
- Massachusetts - Substance List: Oxygen, Isobutylene.
- Missouri - Employer Information/Toxic Substance List: No.
- New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
- North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
- Texas - Hazardous Substance List: No.
- West Virginia - Hazardous Substance List: No.
- Wisconsin - Toxic and Hazardous Substances: No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists.

ADDITIONAL CANADIAN REGULATIONS:

- CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.
- CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.
- CANADIAN WHMIS REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scraping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

- P-1 "Safe Handling of Compressed Gases in Containers"
- AV-1 "Safe Handling and Storage of Compressed Gases"
- "Handbook of Compressed Gases"

PREPARED BY:
CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
619/670-0609
Fax on Demand: 1-800/231-1366

This Material Safety Data Sheet is offered pursuant to OSHA’s Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.
SAFETY DATA SHEET

1. Identification

Product Name: Fluoranthene

Cat No.: AC119170000; AC119170250; AC119171000; AC119175000

Synonyms: Benzo[j,k]fluorene

Recommended Use: Laboratory chemicals.

Uses advised against: No Information available

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information US call: 001-800-ACROS-01
Europe call: +32 14 57 52 11
Emergency Number US: 001-201-796-7100 /
Europe: +32 14 57 52 99

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity
Category 4

Label Elements

Signal Word
Warning

Hazard Statements
Harmful if swallowed

Precautionary Statements

Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>206-44-0</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact
Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.

Inhalation
Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

Ingestion
Do not induce vomiting. Get medical attention.

Most important symptoms/effects No information available.
Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media
Water spray. Carbon dioxide (CO\textsubscript{2}). Dry chemical. alcohol-resistant foam.

Unsuitable Extinguishing Media
No information available

Flash Point
100 °C / 212 °F

Autoignition Temperature
No information available

Explosion Limits
Upper No data available
Lower No data available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO\textsubscript{2})

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

\begin{tabular}{|c|c|c|c|}
\hline
 & Health & Flammability & Instability & Physical hazards \\
\hline
 & 2 & 0 & 0 & N/A \\
\hline
\end{tabular}

6. Accidental release measures

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment.
Environmental Precautions

See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean

Sweep up or vacuum up spillage and collect in suitable container for disposal.

---

### 7. Handling and storage

**Handling**

Ensure adequate ventilation. Wear personal protective equipment. Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Avoid dust formation.

**Storage**

Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

---

### 8. Exposure controls / personal protection

**Exposure Guidelines**

This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

**Engineering Measures**

Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

**Personal Protective Equipment**

**Eye/face Protection**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection**

Wear appropriate protective gloves and clothing to prevent skin exposure.

**Respiratory Protection**

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

---

### 9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Powder Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Light green</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>109 - 111 °C / 228.2 - 231.8 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>384 - 34 °C / 723.2 - 93.2 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>100 °C / 212 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Relative Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No information available</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>C16 H10</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>202.25</td>
</tr>
</tbody>
</table>
10. Stability and reactivity

Reactive Hazard  
None known, based on information available

Stability  
Stable under normal conditions.

Conditions to Avoid  
Incompatible products.

Incompatible Materials  
Strong oxidizing agents

Hazardous Decomposition Products  
Carbon monoxide (CO), Carbon dioxide (CO$_2$)

Hazardous Polymerization  
Hazardous polymerization does not occur.

Hazardous Reactions  
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information  
No acute toxicity information is available for this product

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral (Rat)</th>
<th>LD50 Dermal (Rabbit)</th>
<th>LC50 Inhalation</th>
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</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>2 g/kg</td>
<td>3180 mg/kg</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products  
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation  
No information available

Sensitization  
No information available

Carcinogenicity  
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>206-44-0</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects  
No information available

Reproductive Effects  
No information available.

Developmental Effects  
No information available.

Teratogenicity  
No information available.

STOT - single exposure  
None known

STOT - repeated exposure  
None known

Aspiration hazard  
No information available

Symptoms / effects, both acute and delayed

Endocrine Disruptor Information  
No information available

Other Adverse Effects  
The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity  
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
### Persistence and Degradability

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>Not listed</td>
<td>Oncorhynchus mykiss: LC50=0.0077 mg/L 96h</td>
<td>Not listed</td>
<td>EC50: 0.78 mg/L 20h</td>
</tr>
</tbody>
</table>

**Bioaccumulation/Accumulation**

No information available.

### Mobility

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>5.33</td>
</tr>
</tbody>
</table>

### 13. Disposal Considerations

**Waste Disposal Methods**

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

<table>
<thead>
<tr>
<th>Component</th>
<th>RCRA - U Series Wastes</th>
<th>RCRA - P Series Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene - 206-44-0</td>
<td>U120</td>
<td>-</td>
</tr>
</tbody>
</table>

### 14. Transport Information

**DOT**

- **UN-No**: UN3077
- **Proper Shipping Name**: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
- **Proper technical name**: (Fluoranthene)
- **Hazard Class**: 9
- **Packing Group**: III

**TDG**

- **UN-No**: UN3077
- **Proper Shipping Name**: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
- **Hazard Class**: 9
- **Packing Group**: III

**IATA**

- **UN-No**: UN3077
- **Proper Shipping Name**: Environmentally hazardous substance, solid, n.o.s
- **Hazard Class**: 9
- **Packing Group**: III

**IMDG/IMO**

- **UN-No**: UN3077
- **Proper Shipping Name**: Environmentally hazardous substance, solid, n.o.s
- **Hazard Class**: 9
- **Packing Group**: III

### 15. Regulatory Information

**International Inventories**

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>205-912-4</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**

- X - Listed
- E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
- F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
- N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
- P - Indicates a commenced PMN substance
- R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
- S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
- T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
- XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

**U.S. Federal Regulations**

**TSCA 12(b)** Not applicable

**SARA 313**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>206-44-0</td>
<td>&gt;95</td>
<td>1.0 0.1</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazardous Categorization**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Health Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden Release of Pressure Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reactive Hazard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Clean Water Act**

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Clean Air Act** Not applicable

**OSHA** Occupational Safety and Health Administration
Not applicable

**CERCLA**

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

**California Proposition 65** This product does not contain any Proposition 65 chemicals

**State Right-to-Know**

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoranthene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**U.S. Department of Transportation**

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**

This product does not contain any DHS chemicals.

**Other International Regulations**

**Mexico - Grade** No information available

**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

**WHMIS Hazard Class** D1B Toxic materials
16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 08-Nov-2010
Revision Date 18-Jun-2015
Print Date 18-Jun-2015
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
SAFETY DATA SHEET

Revision Date 10-Feb-2015
Revision Number 1

1. Identification

Product Name Fluorene
Cat No. AC156130000; AC156130250; AC156131000; AC156135000
Synonyms Diphenylenemethane
Recommended Use Laboratory chemicals.
Uses advised against No Information available

Details of the supplier of the safety data sheet

Company Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information US call: 001-800-ACROS-01
Europe call: +32 14 57 52 11
Emergency Number US: 001-201-796-7100 /
Europe: +32 14 57 52 99
CHEMTREC Tel. No.US: 001-800-424-9300 /
Europe: 001-703-527-3887

2. Hazard(s) identification

Classification

Label Elements
None required

Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects
May form combustible dust concentrations in air

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorene</td>
<td>86-73-7</td>
<td>98</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated
Inhalation
Remove from exposure, lie down. Move to fresh air. Obtain medical attention.

Ingestion
Clean mouth with water. Get medical attention.

Most important symptoms/effects
No information available.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

<table>
<thead>
<tr>
<th>Suitable Extinguishing Media</th>
<th>Water spray. Carbon dioxide (CO₂). Dry chemical. chemical foam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsuitable Extinguishing Media</td>
<td>No information available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>151 °C / 303.8 °F</td>
</tr>
<tr>
<td>Method</td>
<td>No information available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Explosion Limits</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Sensitivity to Mechanical Impact</td>
<td>No information available</td>
</tr>
<tr>
<td>Sensitivity to Static Discharge</td>
<td>No information available</td>
</tr>
</tbody>
</table>

Specific Hazards Arising from the Chemical
Dust can form an explosive mixture in air. Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous Combustion Products
None known

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures

<table>
<thead>
<tr>
<th>Personal Precautions</th>
<th>Ensure adequate ventilation. Use personal protective equipment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Precautions</td>
<td>Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained.</td>
</tr>
</tbody>
</table>

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal. Do not let this chemical enter the environment.

7. Handling and storage

<table>
<thead>
<tr>
<th>Handling</th>
<th>Avoid contact with skin and eyes. Do not breathe dust. Do not ingest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>Keep in a dry, cool and well-ventilated place. Keep container tightly closed.</td>
</tr>
</tbody>
</table>

8. Exposure controls / personal protection

<table>
<thead>
<tr>
<th>Exposure Guidelines</th>
<th>This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Measures</td>
<td>Ensure adequate ventilation, especially in confined areas.</td>
</tr>
</tbody>
</table>
9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Powder Solid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Beige</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>112 - 116 °C / 233.6 - 240.8 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>298 °C / 568.4 °F @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>151 °C / 303.8 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>13 hPa @ 146 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Relative Density</td>
<td>1.200</td>
</tr>
<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>C13 H10</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>166.22</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive Hazard</td>
<td>None known, based on information available</td>
</tr>
<tr>
<td>Stability</td>
<td>Stable under normal conditions.</td>
</tr>
<tr>
<td>Conditions to Avoid</td>
<td>Incompatible products.</td>
</tr>
<tr>
<td>Incompatible Materials</td>
<td>Strong oxidizing agents</td>
</tr>
<tr>
<td>Hazardous Decomposition Products</td>
<td>None under normal use conditions</td>
</tr>
<tr>
<td>Hazardous Polymerization</td>
<td>No information available.</td>
</tr>
<tr>
<td>Hazardous Reactions</td>
<td>None under normal processing.</td>
</tr>
</tbody>
</table>

11. Toxicological information

<table>
<thead>
<tr>
<th>Toxicological Information</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Toxicity</td>
<td>No acute toxicity information is available for this product</td>
</tr>
<tr>
<td>Product Information</td>
<td></td>
</tr>
<tr>
<td>Component Information</td>
<td></td>
</tr>
</tbody>
</table>
Fluorene

12. Ecological information

Ecotoxicity
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Persistence and Degradability
Insoluble in water May persist

Bioaccumulation/ Accumulation
No information available.

Mobility
Is not likely mobile in the environment due its low water solubility.

Component | log Pow
--- | ---
Fluorene | 4.18

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
Not regulated

TDG
Not regulated

IATA
UN-No: 3077
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.*
Hazard Class: 9
Packing Group: III
Fluorene

UN-No  3077
Proper Shipping Name  ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class  9
Packing Group  III

15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECS</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>201-695-5</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
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Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)  Not applicable
SARA 313  Not applicable

SARA 311/312 Hazardous Categorization
Acute Health Hazard  No
Chronic Health Hazard  No
Fire Hazard  Yes
Sudden Release of Pressure Hazard  No
Reactive Hazard  No

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorene</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Clean Air Act  Not applicable

OSHA Occupational Safety and Health Administration  Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorene</td>
<td>5000 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

California Proposition 65  This product does not contain any Proposition 65 chemicals

State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Material Name: Fuel Oil No. 2

Synonyms: #2 Heating Oil; 2 Oil; Off-road Diesel Fuel

*** Section 1 - Product and Company Identification ***

Manufacturer Information
Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

*** Section 2 - Hazards Identification ***

GHS Classification:
Flammable Liquids - Category 3
Acute Toxicity, Inhalation - Category 4
Skin Corrosion/Irritation – Category 2
Eye Damage/Irritation – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) – Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS
Symbol(s)

Signal Word
DANGER

Hazard Statements
Flammable liquid and vapor.
Harmful if inhaled.
Causes skin irritation.
Causes eye irritation.
Suspected of causing cancer.
Suspected of causing genetic defects.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.
Precautionary Statements

Prevention
- Keep away from heat/sparks/open flames/hot surfaces. No smoking
- Keep container tightly closed.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Avoid breathing fume/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Wash hands and forearms thoroughly after handling.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Avoid release to the environment.

Response
- In case of fire: Use water spray, fog or foam.
- If on skin (or hair): Wash with plenty of soap and water. Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs, get medical advice/attention.
- If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center or doctor if you feel unwell.
- If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
- If exposed or concerned: Get medical advice/attention.
- If swallowed: Immediately all a poison center or doctor/physician if you feel unwell. Do NOT induce vomiting.

Storage
- Store in a well ventilated place.
- Keep cool. Keep container tightly closed.
- Store locked up.

Disposal
- Dispose of contents/container in accordance with local/regional/national/international regulations.

---

**Section 3 - Composition / Information on Ingredients**

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Component</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>68476-30-2</td>
<td>Fuel oil No. 2</td>
<td>100</td>
</tr>
<tr>
<td>91-20-3</td>
<td>Naphthalene</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>

A complex combination of hydrocarbons with carbon numbers in the range C9 and higher produced from the distillation of petroleum crude oil.
**Section 4 - First Aid Measures**

**First Aid: Eyes**
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

**First Aid: Skin**
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops.

**First Aid: Ingestion**
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

**First Aid: Inhalation**
Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

**Section 5 - Fire Fighting Measures**

**General Fire Hazards**
See Section 9 for Flammability Properties.
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

**Hazardous Combustion Products**
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

**Extinguishing Media**
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or gaseous extinguishing agent.
LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

**Unsuitable Extinguishing Media**
None

**Fire Fighting Equipment/Instructions**
Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

**Section 6 - Accidental Release Measures**

**Recovery and Neutralization**
Carefully contain and stop the source of the spill, if safe to do so.
Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

*** Section 7 - Handling and Storage ***

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this product is loaded into tanks previously containing low flash point products (such as gasoline) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep containers closed and clearly labeled. Use approved vented storage containers. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers; Fluorel ®
*** Section 8 - Exposure Controls / Personal Protection ***

Component Exposure Limits

**Fuel oil No. 2 (270-671-4)**

- **ACGIH:** 100 mg/m³ TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel)
  - Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)
- **Belgium:** 100 mg/m³ TWA (as total hydrocarbon, aerosol and vapor)
  - Skin (listed under Gas oil)
- **Portugal:** 100 mg/m³ TWA [VLE-MP] (aerosol and vapor, as total Hydrocarbons, listed under Fuel diesel)

**Naphthalene (202-049-5)**

- **ACGIH:** 15 ppm STEL
  - 10 ppm TWA
  - Skin - potential significant contribution to overall exposure by the cutaneous route
- **Austria:** 10 ppm TWA [TMW]; 50 mg/m³ TWA [TMW]
  - skin notation
- **Belgium:** 15 ppm STEL; 80 mg/m³ STEL
  - 10 ppm TWA; 53 mg/m³ TWA
  - Skin
- **Denmark:** 10 ppm TWA; 50 mg/m³ TWA
- **Finland:** 2 ppm STEL; 10 mg/m³ STEL
  - 1 ppm TWA; 5 mg/m³ TWA
- **France:** 10 ppm TWA [VME]; 50 mg/m³ TWA [VME]
- **Germany:** 0.1 ppm TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, inhalable fraction, exposure factor 1); 0.5 mg/m³ TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, inhalable fraction, exposure factor 1)
  - Greece: 10 ppm TWA; 50 mg/m³ TWA
  - Ireland: 15 ppm STEL; 75 mg/m³ STEL
  - 10 ppm TWA; 50 mg/m³ TWA
- **Netherlands:** 80 mg/m³ STEL
  - 50 mg/m³ TWA
- **Portugal:** 10 ppm TWA [VLE-MP]
- **Spain:** 15 ppm STEL [VLA-EC]; 80 mg/m³ STEL [VLA-EC]
  - 10 ppm TWA [VLA-ED]; 53 mg/m³ TWA [VLA-ED]
  - skin - potential for cutaneous exposure
- **Sweden:** 10 ppm LLV; 50 mg/m³ LLV
  - 15 ppm STV; 80 mg/m³ STV

**Engineering Measures**

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

**Personal Protective Equipment: Respiratory**

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.
Safety Data Sheet

Material Name: Fuel Oil No. 2

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands
Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes
Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body
Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

*** Section 9 - Physical & Chemical Properties ***

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Red or reddish/orange colored (dyed)</td>
</tr>
<tr>
<td>Odor</td>
<td>Mild, petroleum distillate odor</td>
</tr>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>0.009 psia @ 70 °F (21 °C)</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>340 to 700 °F (171 to 371 °C)</td>
</tr>
<tr>
<td>Solubility (H2O)</td>
<td>Negligible</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Slow; varies with conditions</td>
</tr>
<tr>
<td>Octanol/H2O Coef.</td>
<td>ND</td>
</tr>
<tr>
<td>Flash Point Method</td>
<td>PMCC</td>
</tr>
<tr>
<td>Lower Flammability Limit (LFL)</td>
<td>0.6</td>
</tr>
<tr>
<td>Auto Ignition</td>
<td>494°F (257°C)</td>
</tr>
<tr>
<td>pH</td>
<td>ND</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>&gt;1.0</td>
</tr>
<tr>
<td>Melting Point</td>
<td>ND</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>AP 0.823-0871</td>
</tr>
<tr>
<td>VOC</td>
<td>ND</td>
</tr>
<tr>
<td>Flash Point</td>
<td>100 °F (38 °C) minimum</td>
</tr>
<tr>
<td>Upper Flammability Limit (UFL)</td>
<td>7.5</td>
</tr>
<tr>
<td>Burning Rate</td>
<td>ND</td>
</tr>
<tr>
<td>Flash Point Method</td>
<td>PMCC</td>
</tr>
<tr>
<td>Octanol/H2O Coef.</td>
<td>ND</td>
</tr>
<tr>
<td>Flash Point</td>
<td>100 °F (38 °C) minimum</td>
</tr>
<tr>
<td>Upper Flammability Limit (UFL)</td>
<td>7.5</td>
</tr>
<tr>
<td>Burning Rate</td>
<td>ND</td>
</tr>
<tr>
<td>Auto Ignition</td>
<td>494°F (257°C)</td>
</tr>
</tbody>
</table>

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability
This is a stable material.

Hazardous Reaction Potential
Will not occur.

Conditions to Avoid
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products
Keep away from strong oxidizers; Fluorel ®

Hazardous Decomposition Products
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

*** Section 11 - Toxicological Information ***

Acute Toxicity
A: General Product Information
Harmful if swallowed.
B: Component Analysis - LD50/LC50

Fuel oil No. 2 (68476-30-2)
- Oral LD50 Rat 12 g/kg; Dermal LD50 Rabbit 4720 µL/kg; Dermal LD50 Rabbit >2000 mg/kg; Inhalation LC50 Rat 4.6 mg/L 4 h

Naphthalene (91-20-3)
- Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Product Mixture
- Oral LD50 Rat 14.5 ml/kg; Dermal LD50 Rabbit >5 mL/kg; Guinea Pig Sensitization: negative; Primary dermal irritation: moderately irritating (Draize mean irritation score - 3.98 rabbits); Draize eye irritation: mildly irritating (Draize score, 48 hours, unwashed - 2.0 rabbits)

Potential Health Effects: Skin Corrosion Property/Stimulativeness
- Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness
- Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion
- Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation
- Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization
- This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity
- This product is not reported to have any mutagenic effects. Material of similar composition has been positive in a mutagenicity study.

Carcinogenicity
A: General Product Information
- Suspected of causing cancer.

Dermal carcinogenicity: positive - mice
Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal’s skin with soap and water between applications reduced tumor formation.

This product is similar to Diesel Fuel. IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A) and NIOSH regards it as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

**B: Component Carcinogenicity**

**Fuel oil No. 2 (68476-30-2)**

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

**Naphthalene (91-20-3)**

ACGIH: A4 - Not Classifiable as a Human Carcinogen
NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

**Reproductive Toxicity**

This product is not reported to have any reproductive toxicity effects.

**Specified Target Organ General Toxicity: Single Exposure**

This product is not reported to have any specific target organ general toxicity single exposure effects.

**Specified Target Organ General Toxicity: Repeated Exposure**

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

**Aspiration Respiratory Organs Hazard**

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

### *** Section 12 - Ecological Information ***

**Ecotoxicity**

**A: General Product Information**

Very toxic to aquatic life with long lasting effects. Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

**B: Component Analysis - Ecotoxicity - Aquatic Toxicity**

**Fuel oil No. 2 (68476-30-2)**

<table>
<thead>
<tr>
<th>Test &amp; Species</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 Hr LC50 Pimephales promelas</td>
<td>35 mg/L [flow-through]</td>
</tr>
</tbody>
</table>

**Naphthalene (91-20-3)**

<table>
<thead>
<tr>
<th>Test &amp; Species</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 Hr LC50 Pimephales promelas</td>
<td>5.74-6.44 mg/L [flow-through]</td>
</tr>
<tr>
<td>96 Hr LC50 Oncorhynchus mykiss</td>
<td>1.6 mg/L [flow-through]</td>
</tr>
</tbody>
</table>
Safety Data Sheet

 Persistence/Degradability
 No information available.

 Bioaccumulation
 No information available.

 Mobility in Soil
 No information available.

 *** Section 13 - Disposal Considerations ***

 Waste Disposal Instructions
 See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

 Disposal of Contaminated Containers or Packaging
 Dispose of contents/container in accordance with local/regional/national/international regulations.

 *** Section 14 - Transportation Information ***

 IATA Information
 Shipping Name: Heating oil, light
 UN #: 1202  Hazard Class: 3  Packing Group: III

 ICAO Information
 Shipping Name: Heating oil, light
 UN #: 1202  Hazard Class: 3  Packing Group: III

 IMDG Information
 Shipping Name: Heating oil, light
 UN #: 1202  Hazard Class: 3  Packing Group: III
**Section 15 - Regulatory Information**

**Component Analysis – Inventory**

<table>
<thead>
<tr>
<th>Component/CAS</th>
<th>EC #</th>
<th>EEC</th>
<th>CAN</th>
<th>TSCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel oil No. 2</td>
<td>270-671-4</td>
<td>EINECS</td>
<td>DSL</td>
<td>Yes</td>
</tr>
<tr>
<td>68476-30-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td>202-049-5</td>
<td>EINECS</td>
<td>DSL</td>
<td>Yes</td>
</tr>
<tr>
<td>91-20-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Section 16 - Other Information**

**Key/Legend**

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

**Literature References**

None

**Other Information**

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.
SAFETY DATA SHEET

1. IDENTIFICATION

Product Name: Marathon Petroleum Gasoline - All Grades

Synonym: Gasoline; Regular Unleaded Gasoline; Conventional Regular Unleaded Gasoline; Mid Grade Unleaded Gasoline; Conventional Mid Grade Unleaded Gasoline; Premium Unleaded Gasoline; Conventional Premium Unleaded Gasoline; Sub-Octane Gasoline; Regular RBOB; Super RBOB; Premium RBOB; RBOB; Reformulated Blend Stock For Oxygenated Blending; 84 Octane Gasoline; CBOB; Premium CBOB; Conventional Blend Stock for Oxygenate Blending; Recreational Gasoline; Recreational Gasoline; Recreational Unleaded Gasoline; 89 Recreational Gasoline; Brand 89 Recreational Gasoline; 7.0 Max RVP 89 Recreational Gasoline; BR 7.0 Max RVP 89 Recreational Gasoline; 90 Recreational Gasoline; 90 Marina Gasoline; Brand 91 Recreational Gasoline; 91 Recreational Gasoline; 91 Marina Gasoline; 90 Octane Midgrade Gasoline with No Ethanol; 0125MAR019; 0126MAR019; 0134MAR019; 0313MAR019; 0314MAR019

Chemical Family: Complex Hydrocarbon Substance

Recommended Use: Fuel.

Restrictions on Use: All others.

Manufacturer, Importer, or Responsible Party Name and Address:
MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable liquids</td>
<td>Category 1</td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Germ cell mutagenicity</td>
<td>Category 1B</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 1B</td>
</tr>
<tr>
<td>Reproductive toxicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Aspiration toxicity</td>
<td>Category 1</td>
</tr>
<tr>
<td>Acute aquatic toxicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Chronic aquatic toxicity</td>
<td>Category 2</td>
</tr>
</tbody>
</table>

Hazards Not Otherwise Classified (HNOC)
Static accumulating flammable liquid

**Label elements**

<table>
<thead>
<tr>
<th>Warning</th>
<th>Danger</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExtREMELY FLAMMABLE LIQUID AND VAPOR</td>
<td></td>
</tr>
<tr>
<td>May accumulate electrostatic charge and ignite or explode</td>
<td></td>
</tr>
<tr>
<td>May be fatal if swallowed and enters airways</td>
<td></td>
</tr>
<tr>
<td>Causes skin irritation</td>
<td></td>
</tr>
<tr>
<td>May cause respiratory irritation</td>
<td></td>
</tr>
<tr>
<td>May cause drowsiness or dizziness</td>
<td></td>
</tr>
<tr>
<td>May cause genetic defects</td>
<td></td>
</tr>
<tr>
<td>May cause cancer</td>
<td></td>
</tr>
<tr>
<td>Suspected of damaging fertility or the unborn child</td>
<td></td>
</tr>
<tr>
<td>Toxic to aquatic life with long lasting effects</td>
<td></td>
</tr>
</tbody>
</table>

**Appearance** Clear yellow liquid  
**Physical State** Liquid  
**Odor** Hydrocarbon

**Precautionary Statements - Prevention**

- Obtain special instructions before use
- Do not handle until all safety precautions have been read and understood
- Keep away from heat/sparks/open flames/hot surfaces. - No smoking
- Keep container tightly closed
- Ground/bond container and receiving equipment
- Use explosion-proof electrical/ventilating/lighting/equipment
- Use only non-sparking tools.
- Take precautionary measures against static discharge
- Avoid breathing mist/vapors/spray
- Use only outdoors or in a well-ventilated area
- Wear protective gloves/protective clothing/eye protection/face protection
- Wash hands and any possibly exposed skin thoroughly after handling
- Avoid release to the environment

**Precautionary Statements - Response**

- IF exposed or concerned: Get medical attention
- IF ON SKIN (or hair): Take off immediately all contaminated clothing, Rinse skin with water/shower
- If skin irritation occurs: Get medical attention
- Wash contaminated clothing before reuse
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
- Call a POISON CENTER or doctor if you feel unwell
- IF SWALLOWED: Immediately call a POISON CENTER or doctor
- Do NOT induce vomiting
- In case of fire: Use water spray, fog or regular foam for extinction
- Collect spillage

**Precautionary Statements - Storage**

- Store in a well-ventilated place. Keep container tightly closed
- Keep cool
- Store locked up
Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Gasoline is a complex combination of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons having molecular chains ranging in length from four to ten carbons. May contain small amounts of dye and other additives (>0.02%) which are not considered hazardous at the concentrations used.

Composition Information:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS Number</th>
<th>% Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>86290-81-5</td>
<td>100</td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>142-82-5</td>
<td>2.5-26</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>78-78-4</td>
<td>6.5-19</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>106-97-8</td>
<td>0.5-14</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>107-83-5</td>
<td>2-12</td>
</tr>
<tr>
<td>Toluene</td>
<td>108-88-3</td>
<td>3.9-5</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>1330-20-7</td>
<td>3.5-9.5</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>110-54-3</td>
<td>0.1-4.5</td>
</tr>
<tr>
<td>Cumene</td>
<td>98-82-8</td>
<td>0-4</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene</td>
<td>95-63-6</td>
<td>1-4</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>100-41-4</td>
<td>0.5-2.5</td>
</tr>
<tr>
<td>Benzene</td>
<td>71-43-2</td>
<td>0.1-1.5</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>110-82-7</td>
<td>0-1.5</td>
</tr>
<tr>
<td>Octane</td>
<td>111-65-9</td>
<td>0-1.5</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene</td>
<td>526-73-8</td>
<td>0.1</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>0.1-0.5</td>
</tr>
</tbody>
</table>

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation: Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. If symptoms occur get medical attention.

Skin Contact: Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation persists. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).

Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.
Ingestion: Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects: Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Indication of any immediate medical attention and special treatment needed

Notes To Physician: INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

INGESTION: This material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media
Do not use straight water streams to avoid spreading fire.

Specific hazards arising from the chemical
This product has been determined to be an extremely flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the Emergency Response Guidebook 128.

Hazardous combustion products
Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data
| Sensitivity to Mechanical Impact | No. |
| Sensitivity to Static Discharge   | Yes. |
Special protective equipment and precautions for firefighters
Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water may be ineffective in extinguishing low flash point fires, but can be used to cool exposed surfaces. Avoid excessive water spray application. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Keep run-off water out of sewers and water sources.

Additional firefighting tactics
FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources.

Protective equipment: Use personal protection measures as recommended in Section 8.

Emergency procedures: Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

Environmental precautions: Avoid release to the environment. Avoid subsoil penetration. Ethanol in gasoline phase separates in contact with water. Monitor downstream for dissolved ethanol or other appropriate indicators.

Methods and materials for containment: Contain liquid with sand or soil. Prevent spilled material from entering storm drains, sewers, and open waterways.

Methods and materials for cleaning up: Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers. When recovering free liquids ensure all equipment is grounded and bonded. Use only non-sparking tools.

7. HANDLING AND STORAGE
Safe Handling Precautions:

NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Vapors may travel along the ground or be moved by ventilation. Flashback may occur along vapor trails. No smoking. Use only non-sparking tools. Avoid contact with skin, eyes and clothing. Avoid breathing fumes, gas, or vapors. Use only with adequate ventilation. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

Hydrocarbons are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.

Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.

A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.

Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions:

Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Do not store near an open flame, heat or other sources of ignition.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

<table>
<thead>
<tr>
<th>Name</th>
<th>ACGIH TLV</th>
<th>OSHA PELs:</th>
<th>OSHA - Vacated PELs</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>300 ppm TWA</td>
<td>-</td>
<td>300 ppm TWA</td>
<td>-</td>
</tr>
<tr>
<td>86290-81-5</td>
<td>500 ppm STEL</td>
<td>-</td>
<td>900 mg/m³ TWA</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>500 ppm STEL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1500 mg/m³ STEL</td>
<td></td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>STEL</td>
<td>TWA: 500 ppm</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>400 ppm TWA</td>
<td>500 ppm STEL</td>
<td>TWA: 2000 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>1000 ppm TWA</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>1000 ppm STEL</td>
<td>-</td>
<td>800 ppm TWA</td>
<td></td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>500 ppm TWA</td>
<td>1000 ppm STEL</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Toluene</td>
<td>20 ppm TWA</td>
<td>-</td>
<td>TWA: 200 ppm</td>
<td></td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>100 ppm TWA</td>
<td>150 ppm STEL</td>
<td>TWA: 435 mg/m³</td>
<td></td>
</tr>
<tr>
<td>n-Hexane</td>
<td>50 ppm TWA</td>
<td>-</td>
<td>TWA: 1800 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cumene</td>
<td>50 ppm TWA</td>
<td>-</td>
<td>TWA: 245 mg/m³</td>
<td></td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene</td>
<td>25 ppm TWA</td>
<td>-</td>
<td>25 ppm TWA</td>
<td></td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>20 ppm TWA</td>
<td>-</td>
<td>125 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>0.5 ppm TWA</td>
<td>2.5 ppm STEL</td>
<td>TWA: 10 ppm (applies to industry segments exempt from the benzene standard)</td>
<td></td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>100 ppm TWA</td>
<td>-</td>
<td>TWA: 1000 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Octane</td>
<td>300 ppm TWA</td>
<td>-</td>
<td>TWA: 2350 mg/m³</td>
<td></td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene</td>
<td>25 ppm TWA</td>
<td>-</td>
<td>25 ppm TWA</td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td>10 ppm TWA</td>
<td>-</td>
<td>TWA: 50 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

**Engineering measures:** Local or general exhaust required in an enclosed area or when there is inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof.

**Personal protective equipment**
Eye protection: Use goggles or face-shield if the potential for splashing exists.

Skin and body protection: Use nitrile rubber, Viton® or PVA gloves for repeated or prolonged skin exposure. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.

Respiratory protection: Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values (Method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Clear yellow liquid</td>
</tr>
<tr>
<td>Color</td>
<td>Yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Hydrocarbon</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No data available.</td>
</tr>
<tr>
<td>Property</td>
<td>Values (Method)</td>
</tr>
<tr>
<td>Melting Point / Freezing Point</td>
<td>No data available.</td>
</tr>
<tr>
<td>Initial Boiling Point / Boiling Range</td>
<td>24-210 °C / 75-410 °F (ASTM D86)</td>
</tr>
<tr>
<td>Flash Point</td>
<td>-43 °C / -45 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No data available.</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Flammability Limit in Air (%)</td>
<td></td>
</tr>
<tr>
<td>Upper Flammability Limit</td>
<td>7.6</td>
</tr>
<tr>
<td>Lower Flammability Limit</td>
<td>1.4</td>
</tr>
<tr>
<td>Explosion limits:</td>
<td>No data available.</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>5.5-15 psi (ASTM D4814)</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>3-4</td>
</tr>
<tr>
<td>Specific Gravity / Relative Density</td>
<td>0.70-0.76</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>No data available.</td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>No data available.</td>
</tr>
<tr>
<td>Partition Coefficient</td>
<td>2.13-4.5</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No data available.</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>280 °C / 536 °F</td>
</tr>
<tr>
<td>Kinematic Viscosity</td>
<td>No data available.</td>
</tr>
<tr>
<td>Dynamic Viscosity</td>
<td>No data available.</td>
</tr>
<tr>
<td>Explosive Properties</td>
<td>No data available.</td>
</tr>
<tr>
<td>VOC Content (%)</td>
<td>100%</td>
</tr>
<tr>
<td>Density</td>
<td>No data available.</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Reactivity: The product is non-reactive under normal conditions.

Chemical stability: The material is stable at 70°F, 760 mmHg pressure.

Possibility of hazardous reactions: None under normal processing.

Hazardous polymerization: Will not occur.
Conditions to avoid
Excessive heat, sources of ignition, open flame.

Incompatible Materials
Strong oxidizing agents.

Hazardous decomposition products
None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation
May cause irritation of respiratory tract. May cause drowsiness or dizziness. Breathing high concentrations of this material in a confined space or by intentional abuse can cause irregular heartbeats which can cause death.

Eye contact
Exposure to vapor or contact with liquid may cause mild eye irritation, including tearing, stinging, and redness.

Skin contact
Causes skin irritation. Effects may become more serious with repeated or prolonged contact. May be absorbed through the skin in harmful amounts.

Ingestion
May be fatal if swallowed or vomited and enters airways. May cause irritation of the mouth, throat and gastrointestinal tract.

Acute toxicological data

<table>
<thead>
<tr>
<th>Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline 86290-81-5</td>
<td>14000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>&gt; 5.2 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>Heptane (mixed isomers) 142-82-5</td>
<td>-</td>
<td>3000 mg/kg (Rabbit)</td>
<td>103 g/m³ (Rat) 4 h</td>
</tr>
<tr>
<td>Pentane (mixed isomers) 78-78-4</td>
<td>-</td>
<td>-</td>
<td>450 mg/L (Mouse) 2 h</td>
</tr>
<tr>
<td>Butane (mixed isomers) 106-97-8</td>
<td>-</td>
<td>-</td>
<td>658 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane) 107-83-5</td>
<td>&gt; 5000 mg/kg (Rat)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Toluene 108-88-3</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>8390 mg/kg (Rabbit)</td>
<td>12.5 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>Xylene (mixed isomers) 1330-20-7</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>&gt; 5.04 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>n-Hexane 110-54-3</td>
<td>15000 mg/kg (Rat)</td>
<td>3000 mg/kg (Rabbit)</td>
<td>48000 ppm (Rat) 4 h</td>
</tr>
<tr>
<td>Cumene 98-82-8</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>&gt; 20 mg/L (Rat) 6 h</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene 95-63-6</td>
<td>3280 mg/kg (Rat)</td>
<td>&gt; 3160 mg/kg (Rabbit)</td>
<td>18,000 mg/m³ (Rat) 4 h</td>
</tr>
<tr>
<td>Ethylbenzene 100-41-4</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>17.2 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>Benzene 71-43-2</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>&gt; 5000 mg/kg (Rabbit)</td>
<td>&gt; 20 mg/l (Rat) 4 h</td>
</tr>
<tr>
<td>Cyclohexane 110-82-7</td>
<td>&gt; 5000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>13.9 mg/L (Rat) 4 h</td>
</tr>
<tr>
<td>Octane 111-65-9</td>
<td>-</td>
<td>-</td>
<td>118 g/m³ (Rat) 4 h</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene 526-73-8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Naphthalene 91-20-3</td>
<td>490 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rabbit)</td>
<td>&gt; 340 mg/m³ (Rat) 1 h</td>
</tr>
</tbody>
</table>

Delayed and immediate effects as well as chronic effects from short and long-term exposure
NAPHTHAS: In a large epidemiological study on over 15,000 employees at several petroleum refineries and amongst residents located near these refineries, no increased risk of kidney cancer was observed in association with gasoline exposures (a similar material). In a similar study, no increased risk of kidney cancer was observed among petroleum refinery workers, but there was a slight trend in the incidence of kidney cancers among service station employees, especially after a 30-year latency period. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffer's Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

C9 AROMATIC HYDROCARBONS: A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm.

PENTANES: Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

BUTANES: Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

TOLUENE: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Abuse of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system, and can cause CNS depression, cardiac arrhythmias, and death. Studies of workers indicate longterm exposure may be related to impaired color vision and hearing. Some studies of workers suggest longterm exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest longterm exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals have been largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Adverse effects on the liver, kidney, thymus and nervous system were observed in animal studies following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

XYLENES, ALL ISOMERS: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, nervous system damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross overexposure. Effects from Prolonged or Repeated Exposure: Impaired neurological function was reported
in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure with evidence of maternal toxicity. The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1,2,4-TRIMETHYLBENZENE: The following information pertains to a mixture of C9 aromatic hydrocarbons, over 40% of which was composed of 1,2,4-trimethylbenzene. A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm. Embryotoxicity has been reported in studies of laboratory animals. Adverse effects included increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate.

N-HEXANE: Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Testicular atrophy and partial to full loss of the germ cell line were observed in sub-chronic high-dose inhalation studies of laboratory rodents. These effects appeared irreversible. Rodent reproduction studies have shown evidence of reduced fetal weight but no frank malformations.

CUMENE: Overexposure to cumene may cause upper respiratory tract irritation and CNS depression. Studies in laboratory animals indicate evidence of respiratory tract hyperplasia, and adverse effects on the liver, kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time. Findings from lifetime laboratory rodent inhalation studies were as follows: In F344/N rats: an increased incidence of renal carcinomas and adenomas, respiratory epithelial adenomas, and interstitial cell adenomas of the testes. In B6C3F1 mice: an increased incidence of carcinomas and adenomas of the bronchi and lung, liver neoplasms, hemangiosarcomas of the spleen, and adenomas of the thyroid.

ETHYLBENZENE: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). The incidence of tumors was also elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure with evidence of maternal toxicity. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals have demonstrated evidence of ototoxicity (hearing loss) following exposure levels as low as 300 ppm for 5 days. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

BENZENE: Studies of workers exposed to benzene show clear evidence that overexposure can cause cancer and other diseases of the blood forming organs including Acute
Myelogenous Leukemia (AML), and Aplastic Anemia (AA), an often fatal disease. Some studies suggest overexposure to benzene may also be associated with Myelodysplastic Syndrome (MDS). Findings from a case control study of workers exposed to benzene was reported during the 2009 Benzene Symposium in Munich included an increase in Acute Myeloid Leukemias and Non-Hodgkins Lymphoid Neoplasms (NHLN) of the subtype follicular lymphoma (FL) in some occupational categories. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of AA have been reported in the offspring of persons severely overexposed to benzene. Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and minor skeletal variations. Benzene has been classified as a proven human carcinogen by OSHA and a Group 1 (Carcinogenic to Humans) material by IARC. The current proposed IARC classification for benzene is summarized as follows: Sufficient evidence for Acute Myeloid Leukemia; limited evidence for Acute Lymphatic Leukemia, Chronic Lymphatic Leukemia, Non-Hodgkin Lymphoma, and Multiple Myeloma.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

CARBON MONOXIDE: is a chemical asphyxiant with no warning properties (such as odor). At 400-500 ppm for 1 hour headache and dyspnea may occur. If activity is increased, symptoms of overexposure may include nausea, irritability, increased respiration, tinnitus, sweating, chest pain, confusion, impaired judgement, dizziness, weakness, drowsiness, ataxia, irregular heart beat, cyanosis and pallor. Levels in excess of 1000 ppm can result in collapse, loss of consciousness, respiratory failure and death. Extremely high concentrations (12,800 ppm) can cause immediate unconsciousness and death in 1-3 minutes. Repeated anoxia can lead to central nervous system damage and peripheral neuropathy, with loss of sensation in the fingers, amnesia, and mental deterioration and possible congestive heart failure. Damage may also occur to the fetus, lung, liver, kidney, spleen, cardiovascular system and other organs.

WHOLLY-VAPORIZED UNLEADED GASOLINE: Lifetime exposure to wholly vaporized unleaded gasoline produced an increased incidence of liver tumors in female mice exposed to the highest exposure concentration (2056 ppm) and α-2 urinary globulin-mediated kidney tumors in male rats. No exposure-related tumors were observed in male mice or female rats. The male-specific rat kidney tumors are not considered relevant to human health. Mice receiving lifetime repeated skin application of various petroleum naphthas exhibited an irritation-dependent increased incidence of skin tumors. Additional studies suggest that these tumors occur through a mechanism that may not be relevant to human health. Epidemiological data from over 18,000 petroleum marketing and distribution workers
showed no increased risk of leukemia, multiple myeloma, or kidney cancer resulting from gasoline exposure. Unleaded gasoline has been identified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).

COMBUSTION ENGINE EXHAUST: Chronic inhalation studies of gasoline engine exhaust in mice, rats and hamsters did not produce any carcinogenic effects. Condensates/extracts of gasoline engine exhaust produced an increase in tumors compared to controls when testing by skin painting, subcutaneous injection, intratracheal instillation or implantation into the lungs. Gasoline exhaust has been classified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).

Adverse effects related to the physical, chemical and toxicological characteristics

Signs and Symptoms
Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Sensitization
Not expected to be a skin or respiratory sensitizer.

Mutagenic effects
May cause genetic defects.

Carcinogenicity
May cause cancer.

Cancer designations are listed in the table below

<table>
<thead>
<tr>
<th>Name</th>
<th>ACGIH (Class)</th>
<th>IARC (Class)</th>
<th>NTP</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>Confirmed animal carcinogen (A3)</td>
<td>Possible human carcinogen (2B)</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Toluene</td>
<td>Not Classifiable (A4)</td>
<td>Not Classifiable (3)</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>Not classifiable (A4)</td>
<td>Not classifiable (3)</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Cumene</td>
<td>Not listed</td>
<td>Possible human carcinogen (2B)</td>
<td>Reasonably anticipated to be a human carcinogen</td>
<td>Not listed</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>Confirmed animal carcinogen (A3)</td>
<td>Possible human carcinogen (2B)</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Benzene</td>
<td>Confirmed human carcinogen (A1)</td>
<td>Carcinogenic to humans (1)</td>
<td>Known to be human carcinogen</td>
<td>Known carcinogen</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Octane</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>Confirmed animal carcinogen (A3)</td>
<td>Possible human carcinogen (2B)</td>
<td>Reasonably anticipated to be a human carcinogen</td>
<td>Not Listed</td>
</tr>
</tbody>
</table>

Reproductive toxicity
Suspected of damaging fertility or the unborn child.
Specific Target Organ Toxicity (STOT) - single exposure
Respiratory system. Central nervous system.

Specific Target Organ Toxicity (STOT) - repeated exposure
Not classified.

Aspiration hazard
May be fatal if swallowed or vomited and enters airways.

12. ECOLOGICAL INFORMATION

Ecotoxicity
This product should be considered toxic to aquatic organisms, with the potential to cause long lasting adverse effects in the aquatic environment.

<table>
<thead>
<tr>
<th>Name</th>
<th>Algae/aquatic plants</th>
<th>Fish</th>
<th>Toxicity to Microorganisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline 86290-81-5</td>
<td>72-hr EC50 = 56 mg/l</td>
<td>96-hr LC50 = 11 mg/l</td>
<td>48-hr LC50 = 7.6 mg/l</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Rainbow trout (static)</td>
<td>Daphnia magna</td>
<td></td>
</tr>
<tr>
<td>Heptane (mixed isomers) 142-82-5</td>
<td>-</td>
<td>96-hr LC50 = 375 mg/L</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Tilapia</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pentane (mixed isomers) 78-78-4</td>
<td>-</td>
<td>96-hr LC50 = 3.1 mg/l</td>
<td>-</td>
<td>48-hr EC50 = &gt;1 - &lt;10 mg/L</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Rainbow trout</td>
<td>Daphnia magna</td>
<td></td>
</tr>
<tr>
<td>Butane (mixed isomers) 106-97-8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane 107-83-5)</td>
<td>-</td>
<td>96-hr LC50 = 2.5 mg/l</td>
<td>Fathead minnow</td>
<td>-</td>
</tr>
<tr>
<td>Toluene 108-88-3</td>
<td>72-hr EC50 = 12.5 mg/l</td>
<td>96-hr LC50 &lt;= 10 mg/l</td>
<td>-</td>
<td>48-hr EC50 = 5.46-9.83 mg/L</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Rainbow trout</td>
<td>Daphnia magna</td>
<td>48-hr EC50 = 11.5 mg/L</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>Daphnia magna (Static)</td>
<td></td>
</tr>
<tr>
<td>Xylene (mixed isomers) 1330-20-7</td>
<td>72-hr EC50 = 11 mg/l</td>
<td>96-hr LC50 = 8 mg/l</td>
<td>-</td>
<td>48-hr LC50 = 3.82 mg/l</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Rainbow trout</td>
<td>Daphnia magna</td>
<td></td>
</tr>
<tr>
<td>n-Hexane 110-54-3</td>
<td>-</td>
<td>96-hr LC50 = 2.5 mg/l</td>
<td>Fathead minnow</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Cumene 98-82-8</td>
<td>72-hr EC50 = 2.6 mg/l</td>
<td>96-hr LC50 = 6.04-6.61 mg/l</td>
<td>-</td>
<td>48-hr EC50 = 7.9-14.1 mg/l</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Fathead minnow (Flow-through)</td>
<td>96-hr LC50 = 2.7 mg/l</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Fathead minnow (semi-static)</td>
<td>-</td>
<td>Daphnia magna (Static)</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene 95-63-6</td>
<td>-</td>
<td>96-hr LC50 = 7.19-8.28 mg/l</td>
<td>-</td>
<td>48-hr EC50 = 6.14 mg/L</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Fathead minnow (flow-through)</td>
<td>-</td>
<td>Daphnia magna</td>
</tr>
<tr>
<td>Ethylbenzene 100-41-4</td>
<td>72-hr EC50 = 1.7-7.6 mg/l</td>
<td>96-hr LC50 = 4 mg/L</td>
<td>-</td>
<td>48-hr EC50 = 1.4 mg/L</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Rainbow trout</td>
<td>Daphnia magna</td>
<td></td>
</tr>
<tr>
<td>Benzene 71-43-2</td>
<td>72-hr EC50 = 29 mg/l</td>
<td>96-hr LC50 = 5.3 mg/l</td>
<td>-</td>
<td>48-hr EC50 = 8.76-15.6 mg/L</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Rainbow trout (flow-through)</td>
<td>-</td>
<td>Daphnia magna (Static)</td>
</tr>
<tr>
<td>Cyclohexane 110-82-7</td>
<td>72-hr EC50 = 500 mg/l</td>
<td>96-hr LC50 = 3.96-5.18 mg/l</td>
<td>-</td>
<td>48-hr EC50 = 1.7-3.5 mg/L</td>
</tr>
<tr>
<td></td>
<td>Algae</td>
<td>Fathead minnow</td>
<td>-</td>
<td>Bay shrimp</td>
</tr>
<tr>
<td>Octane 111-85-9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48-hr LC50 = 0.38 mg/l</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene 526-73-8</td>
<td>-</td>
<td>96-hr LC50 = 7.72 mg/l</td>
<td>-</td>
<td>Daphnia magna</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Fathead Minnow (flow-through)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Naphthalene 91-20-3</td>
<td>-</td>
<td>96-hr LC50 = 0.91-2.82 mg/l</td>
<td>-</td>
<td>48-hr LC50 = 1.6 mg/l</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Rainbow trout (static)</td>
<td>Daphnia magna</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>96-hr LC50 = 1.99 mg/l</td>
<td>Fathead minnow (static)</td>
<td></td>
</tr>
</tbody>
</table>

Persistence and degradability
Expected to be inherently biodegradable. The presence of ethanol in this product may impede the biodegradation of benzene, toluene, ethylbenzene and xylene in groundwater, resulting in elongated plumes of these constituents.
Bioaccumulation
Has the potential to bioaccumulate.

Mobility in soil
May partition into air, soil and water.

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues
This material may be a flammable liquid waste.

Safe Handling of Wastes
Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

Disposal of Wastes / Methods of Disposal
The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal
Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):
- UN Proper Shipping Name: Gasoline
- UN/Identification No: UN 1203
- Transport Hazard Class(es): 3
- Packing Group: II

TDG (Canada):
- UN Proper Shipping Name: Gasoline
- UN/Identification No: UN 1203
- Transport Hazard Class(es): 3
- Packing Group: II

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b):
This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302:
This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List.

<table>
<thead>
<tr>
<th>Name</th>
<th>CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>NA</td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>NA</td>
</tr>
<tr>
<td>Toluene</td>
<td>NA</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Name</td>
<td>Hazardous Substances RQs</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Gasoline</td>
<td>NA</td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>NA</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>NA</td>
</tr>
<tr>
<td>Toluene</td>
<td>1000 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>454 kg final RQ</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>100 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>45.4 kg final RQ</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>5000 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>2270 kg final RQ</td>
</tr>
<tr>
<td>Cumene</td>
<td>5000 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>2270 kg final RQ</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene</td>
<td>NA</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>1000 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>454 kg final RQ</td>
</tr>
<tr>
<td>Benzene</td>
<td>10 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>4.54 kg final RQ</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>1000 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>454 kg final RQ</td>
</tr>
<tr>
<td>Octane</td>
<td>NA</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene</td>
<td>NA</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>100 lb final RQ</td>
</tr>
<tr>
<td></td>
<td>45.4 kg final RQ</td>
</tr>
</tbody>
</table>

SARA: The following EPA hazard categories apply to this product:
Acute Health Hazard
Chronic Health Hazard
Fire Hazard

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

<table>
<thead>
<tr>
<th>Name</th>
<th>CERCLA/SARA 313 Emission reporting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>None</td>
</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>None</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>None</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>None</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>None</td>
</tr>
<tr>
<td>Toluene</td>
<td>1.0 % de minimis concentration</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>1.0 % de minimis concentration</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>1.0 % de minimis concentration</td>
</tr>
<tr>
<td>Cumene</td>
<td>1.0 % de minimis concentration</td>
</tr>
</tbody>
</table>
1,2,4 Trimethylbenzene | 1.0 % de minimis concentration  
Ethylbenzene | 0.1 % de minimis concentration  
Benzene | 0.1 % de minimis concentration  
Cyclohexane | 1.0 % de minimis concentration  
Octane | None  
1,2,3-trimethylbenzene | None  
Naphthalene | 0.1 % de minimis concentration

State and Community Right-To-Know Regulations:
The following component(s) of this material are identified on the regulatory lists below:

Gasoline:
- Louisiana Right-To-Know: Not Listed
- California Proposition 65: Not Listed
- New Jersey Right-To-Know: SN 0957
- Pennsylvania Right-To-Know: Present
- Massachusetts Right-To-Know: Present
- Florida Substance List: Not Listed
- Rhode Island Right-To-Know: Not Listed
- Michigan Critical Materials Register List: Not Listed
- Massachusetts Extraordinarily Hazardous Substances: Not Listed
- California - Regulated Carcinogens: Not Listed
- Pennsylvania RTK - Special Hazardous Substances:
  - New Jersey - Special Hazardous Substances: Carcinogen; Flammable - third degree
  - New Jersey - Environmental Hazardous Substances List:
- Illinois - Toxic Air Contaminants:
- New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Heptane (mixed isomers):
- Louisiana Right-To-Know: Not Listed
- California Proposition 65: Not Listed
- New Jersey Right-To-Know: SN 1339
- Pennsylvania Right-To-Know: Present
- Massachusetts Right-To-Know: Present
- Florida Substance List: Not Listed
- Rhode Island Right-To-Know: Toxic; Flammable
- Michigan Critical Materials Register List: Not Listed
- Massachusetts Extraordinarily Hazardous Substances: Not Listed
- California - Regulated Carcinogens: Not Listed
- Pennsylvania RTK - Special Hazardous Substances:
  - New Jersey - Special Hazardous Substances: Flammable - third degree
  - New Jersey - Environmental Hazardous Substances List:
  - Illinois - Toxic Air Contaminants:
  - New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Pentane (mixed isomers):
- Louisiana Right-To-Know: Not Listed
- California Proposition 65: Not Listed
- New Jersey Right-To-Know: SN 1064
- Pennsylvania Right-To-Know: Present
- Massachusetts Right-To-Know: Present
- Florida Substance List: Not Listed
- Rhode Island Right-To-Know: Not Listed
- Michigan Critical Materials Register List: Not Listed
- Massachusetts Extraordinarily Hazardous Substances: Not Listed
<table>
<thead>
<tr>
<th>Database/State</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
<td>Flammable - fourth degree</td>
</tr>
<tr>
<td>New Jersey - Environmental Hazardous Substances List:</td>
<td>SN 1064 TPQ: 500 lb</td>
</tr>
<tr>
<td>Illinois - Toxic Air Contaminants:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
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</table>

**Butane (mixed isomers):**

<table>
<thead>
<tr>
<th>Database/State</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louisiana Right-To-Know:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>California Proposition 65:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey Right-To-Know:</td>
<td>SN 0273</td>
</tr>
<tr>
<td>Pennsylvania Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Massachusetts Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Florida Substance List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Toxic; Flammable</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
<td>Flammable - fourth degree</td>
</tr>
<tr>
<td>New Jersey - Environmental Hazardous Substances List:</td>
<td>SN 0273 TPQ: 500 lb</td>
</tr>
<tr>
<td>Illinois - Toxic Air Contaminants:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
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</tr>
</tbody>
</table>

**Hexane Isomers (other than n-Hexane):**

<table>
<thead>
<tr>
<th>Database/State</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louisiana Right-To-Know:</td>
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</tr>
<tr>
<td>California Proposition 65:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey Right-To-Know:</td>
<td>SN 1285</td>
</tr>
<tr>
<td>Pennsylvania Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Massachusetts Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Florida Substance List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
<td>Not Listed</td>
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<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
<td>Flammable - third degree</td>
</tr>
<tr>
<td>New Jersey - Environmental Hazardous Substances List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Illinois - Toxic Air Contaminants:</td>
<td>Not Listed</td>
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<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
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</tr>
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**Toluene:**

<table>
<thead>
<tr>
<th>Database/State</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>Louisiana Right-To-Know:</td>
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</tr>
<tr>
<td>California Proposition 65:</td>
<td>Developmental toxicity, initial date 1/1/91</td>
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<tr>
<td>New Jersey Right-To-Know:</td>
<td>Female reproductive toxicity, initial date 8/7/09</td>
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<tr>
<td>Pennsylvania Right-To-Know:</td>
<td>SN 1866</td>
</tr>
<tr>
<td>Massachusetts Right-To-Know:</td>
<td>Environmental hazard</td>
</tr>
<tr>
<td>Florida Substance List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Toxic (skin); Flammable (skin)</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
<td>100 lb Annual usage threshold</td>
</tr>
<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
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</tr>
<tr>
<td>Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>State</td>
<td>Hazardous Substance List</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>New Jersey - Special Hazardous Substances</td>
<td>Flammable - third degree; Teratogen</td>
</tr>
<tr>
<td>New Jersey - Environmental Hazardous Substances List</td>
<td>SN 1866 TPQ: 500 lb</td>
</tr>
<tr>
<td>Illinois - Toxic Air Contaminants:</td>
<td>Present</td>
</tr>
<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
<td>1000 lb RQ (air); 1 lb RQ (land/water)</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td></td>
</tr>
<tr>
<td>Louisiana Right-To-Know:</td>
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</tr>
<tr>
<td>California Proposition 65:</td>
<td>Not Listed</td>
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<td>New Jersey Right-To-Know:</td>
<td>SN 2014</td>
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<td>Pennsylvania Right-To-Know:</td>
<td>Environmental hazard</td>
</tr>
<tr>
<td>Massachusetts Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Florida Substance List:</td>
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</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Toxic (skin); Flammable (skin)</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
<td>100 lb Annual usage threshold all isomers</td>
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<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
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</tr>
<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
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</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
<td>Flammable - third degree</td>
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<tr>
<td>New Jersey - Environmental Hazardous Substances List</td>
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<tr>
<td>Illinois - Toxic Air Contaminants:</td>
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<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
<td>1000 lb RQ (air); 1 lb RQ (land/water)</td>
</tr>
<tr>
<td>n-Hexane</td>
<td></td>
</tr>
<tr>
<td>Louisiana Right-To-Know:</td>
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</tr>
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<td>California Proposition 65:</td>
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<td>New Jersey Right-To-Know:</td>
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<tr>
<td>Florida Substance List:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Toxic; Flammable</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
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<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
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<tr>
<td>California - Regulated Carcinogens:</td>
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<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
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</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
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<tr>
<td>New Jersey - Environmental Hazardous Substances List</td>
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<tr>
<td>New York - Reporting of Releases Part 597 - List of Hazardous Substances:</td>
<td>1 lb RQ (air); 1 lb RQ (land/water)</td>
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<tr>
<td>Cumene</td>
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<tr>
<td>Louisiana Right-To-Know:</td>
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</tr>
<tr>
<td>California Proposition 65:</td>
<td>Carcinogen, initial date 4/6/10</td>
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<tr>
<td>New Jersey Right-To-Know:</td>
<td>SN 0542</td>
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<tr>
<td>Pennsylvania Right-To-Know:</td>
<td>Environmental hazard</td>
</tr>
<tr>
<td>Massachusetts Right-To-Know:</td>
<td>Present</td>
</tr>
<tr>
<td>Florida Substance List:</td>
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</tr>
<tr>
<td>Rhode Island Right-To-Know:</td>
<td>Toxic (skin); Flammable (skin)</td>
</tr>
<tr>
<td>Michigan Critical Materials Register List:</td>
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</tr>
<tr>
<td>Massachusetts Extraordinarily Hazardous Substances:</td>
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</tr>
<tr>
<td>California - Regulated Carcinogens:</td>
<td>Not Listed</td>
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<tr>
<td>Pennsylvania RTK - Special Hazardous Substances:</td>
<td>Not Listed</td>
</tr>
<tr>
<td>New Jersey - Special Hazardous Substances:</td>
<td>Flammable - third degree</td>
</tr>
<tr>
<td>New Jersey - Environmental Hazardous Substances List</td>
<td>SN 0542 TPQ: 500 lb</td>
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<td>Illinois - Toxic Air Contaminants:</td>
<td>Present</td>
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</tbody>
</table>
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

1,2,4 Trimethylbenzene

Louisiana Right-To-Know: Not Listed
California Proposition 65: Not Listed
New Jersey Right-To-Know: SN 1929
Pennsylvania Right-To-Know: Present
Massachusetts Right-To-Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
New Jersey - Special Hazardous Substances: Not Listed
New Jersey - Environmental Hazardous Substances List:
Illinois - Toxic Air Contaminants: Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Ethylbenzene

Louisiana Right-To-Know: Not Listed
California Proposition 65: Carcinogen, initial date 6/11/04
New Jersey Right-To-Know: SN 0851
Pennsylvania Right-To-Know: Environmental hazard
Massachusetts Right-To-Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic; Flammable
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
New Jersey - Special Hazardous Substances: Carcinogen; flammable - Third degree
New Jersey - Environmental Hazardous Substances List:
Illinois - Toxic Air Contaminants: Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Benzene

Louisiana Right-To-Know: Not Listed
California Proposition 65: Carcinogen, initial date 2/27/87
New Jersey Right-To-Know: SN 0197
Pennsylvania Right-To-Know: Environmental hazard; Special hazardous substance
Massachusetts Right-To-Know: Carcinogen; Extraordinarily hazardous
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic (skin); Flammable (skin); Carcinogen (skin)
Michigan Critical Materials Register List: 100 lb Annual usage threshold
Massachusetts Extraordinarily Hazardous Substances: Carcinogen; Extraordinarily hazardous
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Present
New Jersey - Special Hazardous Substances: Carcinogen; Flammable - third degree; Mutagen
New Jersey - Environmental Hazardous Substances List:
Illinois - Toxic Air Contaminants: Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

SDS ID NO.: 0127MAR019 Product name: Marathon Petroleum Gasoline - All Grades Page 20 of 23
Cyclohexane
Louisiana Right-To-Know: Not Listed
California Proposition 65: Not Listed
New Jersey Right-To-Know: SN 0565
Pennsylvania Right-To-Know: Environmental hazard
Massachusetts Right-To-Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic; Flammable
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
New Jersey - Special Hazardous Substances: Flammable - third degree
New Jersey - Environmental Hazardous Substances List: SN 0565 TPQ: 500 lb
Illinois - Toxic Air Contaminants: Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Octane
Louisiana Right-To-Know: Not Listed
California Proposition 65: Not Listed
New Jersey Right-To-Know: SN 1434
Pennsylvania Right-To-Know: Present
Massachusetts Right-To-Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic; Flammable
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
New Jersey - Special Hazardous Substances: Flammable - third degree
New Jersey - Environmental Hazardous Substances List: Not Listed
Illinois - Toxic Air Contaminants: Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

1,2,3-trimethylbenzene
Louisiana Right-To-Know: Not Listed
California Proposition 65: Not Listed
New Jersey Right-To-Know: SN 1929
Pennsylvania Right-To-Know: Present
Massachusetts Right-To-Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
New Jersey - Special Hazardous Substances: Not Listed
New Jersey - Environmental Hazardous Substances List: Not Listed
Illinois - Toxic Air Contaminants: Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:

Naphthalene
Louisiana Right-To-Know: Not Listed
California Proposition 65: Carcinogen, initial date 4/19/02
New Jersey Right-To-Know: SN 1322 SN 3758
Pennsylvania Right-To-Know: Environmental hazard Present (particulate)
Massachusetts Right-To Know: Present
Florida Substance List: Not Listed
Rhode Island Right-To-Know: Toxic; Flammable
Michigan Critical Materials Register List: Not Listed
Massachusetts Extraordinarily Hazardous Substances: Not Listed
California - Regulated Carcinogens: Not Listed
Pennsylvania RTK - Special Hazardous Substances: Not Listed
Rhode Island Right-To-Know: Toxic; Flammable
Massachusetts Extraordinarily Hazardous Substances: Not Listed

Canada DSL/NDSL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations.

<table>
<thead>
<tr>
<th>Name</th>
<th>Canada - WHMIS: Classifications of Substances:</th>
<th>Canada - WHMIS: Ingredient Disclosure:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>B2,D2A,D2B</td>
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</tr>
<tr>
<td>Heptane (mixed isomers)</td>
<td>B2,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>Pentane (mixed isomers)</td>
<td>B2</td>
<td>1%</td>
</tr>
<tr>
<td>Butane (mixed isomers)</td>
<td>A,B1</td>
<td>1%</td>
</tr>
<tr>
<td>Hexane Isomers (other than n-Hexane)</td>
<td>B2</td>
<td>1%</td>
</tr>
<tr>
<td>Toluene</td>
<td>B2,D2A,D2B</td>
<td>0.1%</td>
</tr>
<tr>
<td>Xylene (mixed isomers)</td>
<td>B2,D2A,D2B</td>
<td>m-, o-isomers 1.0%; p-isomer 0.1%</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>B2,D2A,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>Cumene</td>
<td>B2,D2A</td>
<td>0.1%</td>
</tr>
<tr>
<td>1,2,4 Trimethylbenzene</td>
<td>B3,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>B2,D2A,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>Benzene</td>
<td>B2,D2A,D2B</td>
<td>0.1%</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>B2,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>Octane</td>
<td>B2,D2B</td>
<td>1%</td>
</tr>
<tr>
<td>1,2,3-trimethylbenzene</td>
<td>B3</td>
<td>1%</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>B4,D2A</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Note: Not applicable.

16. OTHER INFORMATION

Prepared By: Toxicology and Product Safety
Revision Date: 06/01/2016
Revision Note:
Revised Sections

The following sections ($) have been updated:
1. IDENTIFICATION
2. HAZARD IDENTIFICATION
3. COMPOSITION/INFORMATION ON INGREDIENTS
4. FIRST AID MEASURES
6. ACCIDENTAL RELEASE MEASURES
7. HANDLING AND STORAGE
8. EXPOSURE CONTROLS/PERSONAL PROTECTION
9. PHYSICAL AND CHEMICAL PROPERTIES
11. TOXICOLOGICAL INFORMATION
12. ECOLOGICAL INFORMATION
15. REGULATORY INFORMATION

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
SAFETY DATA SHEET

Helium

Section 1. Identification

GHS product identifier : Helium
Chemical name : Helium
Other means of identification : helium (dot); Helium-4; He; o-Helium; UN 1046
Product use : Synthetic/Analytical chemistry.
Synonym : helium (dot); Helium-4; He; o-Helium; UN 1046
SDS # : 001025
Supplier’s details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture : GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms : 

Signal word : Warning
Hazard statements : Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS’S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.
Prevention : Use and store only outdoors or in a well ventilated place.
Response : Not applicable.
Storage : Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal : Not applicable.
Hazard not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Date of issue/Date of revision : 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 1/11
Section 3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Substance/mixture</th>
<th>Chemical name</th>
<th>Other means of identification</th>
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<tbody>
<tr>
<td>Substance</td>
<td>Helium</td>
<td>helium (dot); Helium-4; He; o-Helium; UN 1046</td>
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</tbody>
</table>

**CAS number/other identifiers**
- **CAS number**: 7440-59-7
- **Product code**: 001025

<table>
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<th>Ingredient name</th>
<th>%</th>
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<tbody>
<tr>
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<td>100</td>
<td>7440-59-7</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

**Description of necessary first aid measures**

**Eye contact**: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

**Inhalation**: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

**Skin contact**: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

**Ingestion**: As this product is a gas, refer to the inhalation section.

**Most important symptoms/effects, acute and delayed**

**Potential acute health effects**
- **Eye contact**: Contact with rapidly expanding gas may cause burns or frostbite.
- **Inhalation**: No known significant effects or critical hazards.
- **Skin contact**: Contact with rapidly expanding gas may cause burns or frostbite.
- **Frostbite**: Try to warm up the frozen tissues and seek medical attention.
- **Ingestion**: As this product is a gas, refer to the inhalation section.

**Over-exposure signs/symptoms**
- **Eye contact**: No specific data.
- **Inhalation**: No specific data.
- **Skin contact**: No specific data.
- **Ingestion**: No specific data.

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to physician**: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Date of issue/Date of revision: 10/15/2014. Date of previous issue: 10/2/2014. Version: 0.02
Helium

Section 4. First aid measures

Specific treatments: No specific treatment.
Protection of first-aiders: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media: Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical

Hazardous thermal decomposition products: Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Specific hazards arising from the chemical

No specific data.

Special protective actions for fire-fighters: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders: If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions: Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill: Immediately contact emergency personnel. Stop leak if without risk.
Large spill: Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.
Section 7. Handling and storage

Precautions for safe handling

Protective measures: Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Advice on general occupational hygiene: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities: Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>Oxygen Depletion [Asphyxiant]</td>
</tr>
</tbody>
</table>

Appropriate engineering controls: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Date of issue/Date of revision: 10/15/2014. Date of previous issue: 10/2/2014. Version: 0.02
Section 8. Exposure controls/personal protection

**Hand protection**: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

**Body protection**: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Other skin protection**: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Respiratory protection**: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

**Appearance**

- **Physical state**: Gas. [Compressed gas.]
- **Color**: Colorless.
- **Molecular weight**: 4 g/mole
- **Molecular formula**: He

- **Boiling/condensation point**: -268.9°C (-452°F)
- **Melting/freezing point**: -272.2°C (-458°F)
- **Critical temperature**: -267.9°C (-450.2°F)

- **Odor**: Odorless.
- **Odor threshold**: Not available.
- **pH**: Not available.
- **Flash point**: [Product does not sustain combustion.]

- **Burning time**: Not applicable.
- **Burning rate**: Not applicable.
- **Evaporation rate**: Not applicable.
- **Flammability (solid, gas)**: Not available.
- **Lower and upper explosive (flammable) limits**: Not available.

- **Vapor pressure**: Not available.
- **Vapor density**: 0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft³ (125 kg/m³)

- **Specific Volume (ft³/lb)**: 96.1538
- **Gas Density (lb/ft³)**: 0.0104

- **Relative density**: Not applicable.
- **Solubility**: Not available.
- **Solubility in water**: Not available.

- **Partition coefficient: n-octanol/water**: 0.28

- **Auto-ignition temperature**: Not available.
- **Decomposition temperature**: Not available.
Section 9. Physical and chemical properties

- **SADT**: Not available.
- **Viscosity**: Not applicable.

Section 10. Stability and reactivity

- **Reactivity**: No specific test data related to reactivity available for this product or its ingredients.
- **Chemical stability**: The product is stable.
- **Possibility of hazardous reactions**: Under normal conditions of storage and use, hazardous reactions will not occur.
- **Conditions to avoid**: No specific data.
- **Hazardous decomposition products**: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
- **Hazardous polymerization**: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

**Information on toxicological effects**

- **Acute toxicity**: Not available.
- **Irritation/Corrosion**: Not available.
- **Sensitization**: Not available.
- **Mutagenicity**: Not available.
- **Carcinogenicity**: Not available.
- **Reproductive toxicity**: Not available.
- **Teratogenicity**: Not available.
- **Specific target organ toxicity (single exposure)**: Not available.
- **Specific target organ toxicity (repeated exposure)**: Not available.
- **Aspiration hazard**: Not available.
Section 11. Toxicological information

Information on the likely routes of exposure: Not available.

Potential acute health effects

- **Eye contact**: Contact with rapidly expanding gas may cause burns or frostbite.
- **Inhalation**: No known significant effects or critical hazards.
- **Skin contact**: Contact with rapidly expanding gas may cause burns or frostbite.
- **Ingestion**: As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

- **Eye contact**: No specific data.
- **Inhalation**: No specific data.
- **Skin contact**: No specific data.
- **Ingestion**: No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

- **Short term exposure**
  - **Potential immediate effects**: Not available.
  - **Potential delayed effects**: Not available.

- **Long term exposure**
  - **Potential immediate effects**: Not available.
  - **Potential delayed effects**: Not available.

Potential chronic health effects

- General: No known significant effects or critical hazards.
- Carcinogenicity: No known significant effects or critical hazards.
- Mutagenicity: No known significant effects or critical hazards.
- Teratogenicity: No known significant effects or critical hazards.
- Developmental effects: No known significant effects or critical hazards.
- Fertility effects: No known significant effects or critical hazards.

Numerical measures of toxicity

- **Acute toxicity estimates**: Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.
## Section 12. Ecological information

### Bioaccumulative potential

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>LogP&lt;sub&gt;ow&lt;/sub&gt;</th>
<th>BCF</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>0.28</td>
<td>-</td>
<td>low</td>
</tr>
</tbody>
</table>

### Mobility in soil

**Soil/water partition coefficient (K<sub>OC</sub>):** Not available.

### Other adverse effects

: No known significant effects or critical hazards.

## Section 13. Disposal considerations

**Disposal methods:** The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

## Section 14. Transport information

<table>
<thead>
<tr>
<th>UN number</th>
<th>DOT</th>
<th>TDG</th>
<th>Mexico</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
<td>UN1046</td>
</tr>
</tbody>
</table>

**UN proper shipping name:** HELIUM, COMPRESSED

**Transport hazard class(es):** 2.2

**Packing group:** -

**Environment:** No.

**Additional information:**
- **Limited quantity:** Yes.
- **Passenger aircraft:** Quantity limitation: 75 kg
- **Cargo aircraft:** Quantity limitation: 150 kg
- **Explosive Limit and Limited Quantity Index:** 0.125
- **Passenger Carrying Road or Rail Index:** 75
- **Passenger and Cargo Aircraft:** Quantity limitation: 75 kg
- **Cargo Aircraft Only:** Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”
Section 14. Transport information

Special precautions for user: Transport within user’s premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory information

U.S. Federal regulations: TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs): Not listed
Clean Air Act Section 602 Class I Substances: Not listed
Clean Air Act Section 602 Class II Substances: Not listed
DEA List I Chemicals (Precursor Chemicals): Not listed
DEA List II Chemicals (Essential Chemicals): Not listed

SARA 302/304
Composition/information on ingredients
No products were found.

SARA 304 RQ: Not applicable.

SARA 311/312
Classification: Sudden release of pressure

Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helium</td>
<td>100</td>
<td>No.</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
</tbody>
</table>

State regulations

Massachusetts: This material is listed.
New York: This material is not listed.
New Jersey: This material is listed.
Pennsylvania: This material is listed.
Canada inventory: This material is listed or exempted.

International regulations

Date of issue/Date of revision: 10/15/2014. Date of previous issue: 10/2/2014. Version: 0.02
### Section 15. Regulatory information

<table>
<thead>
<tr>
<th>International lists</th>
<th>Australia inventory (AICS): This material is listed or exempted.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China inventory (IECSC): This material is listed or exempted.</td>
</tr>
<tr>
<td></td>
<td>Japan inventory: Not determined.</td>
</tr>
<tr>
<td></td>
<td>Korea inventory: This material is listed or exempted.</td>
</tr>
<tr>
<td></td>
<td>Malaysia Inventory (EHS Register): Not determined.</td>
</tr>
<tr>
<td></td>
<td>New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.</td>
</tr>
<tr>
<td></td>
<td>Philippines inventory (PICCS): This material is listed or exempted.</td>
</tr>
<tr>
<td></td>
<td>Taiwan inventory (CSNN): Not determined.</td>
</tr>
<tr>
<td></td>
<td><strong>Chemical Weapons Convention List Schedule</strong></td>
</tr>
<tr>
<td></td>
<td>I Chemicals: Not listed</td>
</tr>
<tr>
<td></td>
<td>II Chemicals: Not listed</td>
</tr>
<tr>
<td></td>
<td>III Chemicals: Not listed</td>
</tr>
<tr>
<td></td>
<td><strong>Canada</strong></td>
</tr>
<tr>
<td></td>
<td>WHMIS (Canada): Class A: Compressed gas.</td>
</tr>
<tr>
<td></td>
<td>CEPA Toxic substances: This material is not listed.</td>
</tr>
<tr>
<td></td>
<td>Canadian ARET: This material is not listed.</td>
</tr>
<tr>
<td></td>
<td>Canadian NPRI: This material is not listed.</td>
</tr>
<tr>
<td></td>
<td>Alberta Designated Substances: This material is not listed.</td>
</tr>
<tr>
<td></td>
<td>Ontario Designated Substances: This material is not listed.</td>
</tr>
<tr>
<td></td>
<td>Quebec Designated Substances: This material is not listed.</td>
</tr>
</tbody>
</table>

### Section 16. Other information

**Canada Label requirements**: Class A: Compressed gas.

**Hazardous Material Information System (U.S.A.)**

<table>
<thead>
<tr>
<th>Health</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>0</td>
</tr>
<tr>
<td>Physical hazards</td>
<td>0</td>
</tr>
</tbody>
</table>

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

**National Fire Protection Association (U.S.A.)**

| Flammability | 0 |
| Health | 0 |
| Special | SA |

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**Date of issue/Date of revision**: 10/15/2014. **Date of previous issue**: 10/2/2014. **Version**: 0.02 10/11
Section 16. Other information

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing : 10/15/2014.
Date of issue/Date of revision : 10/15/2014.
Date of previous issue : 10/2/2014.
Version : 0.02

Key to abbreviations

ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
UN = United Nations
ACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: Heptane
Product Number: 246654
Brand: Sigma-Aldrich
Index-No.: 601-008-00-2
CAS-No.: 142-82-5

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Signal word

Hazard statement(s)
- H225: Highly flammable liquid and vapour.
- H304: May be fatal if swallowed and enters airways.
- H315: Causes skin irritation.
- H336: May cause drowsiness or dizziness.
- H410: Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
- P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/ eye protection/ face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane</td>
<td>Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1: H225, H304, H315, H336, H410</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.
In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Flash back possible over considerable distance.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion. Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment. Keep away from sources of ignition. No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store under inert gas. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated
### 8. EXPOSURE CONTROLS/PERSOAL PROTECTION

#### 8.1 Control parameters

**Components with workplace control parameters**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane</td>
<td>142-82-5</td>
<td>TWA 85.000000 ppm</td>
<td>350.000000 ppm mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 440.000000 ppm</td>
<td>1,800.000000 ppm mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remarks</td>
<td>15 minute ceiling value</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 500.000000 ppm</td>
<td>2,000.000000 ppm mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The value in mg/m³ is approximate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 400.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL 500.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 400.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL 500.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 400 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL 500 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
</tbody>
</table>

#### 8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 65 min
Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Appearance</td>
<td>Form: liquid</td>
</tr>
<tr>
<td>b) Odour</td>
<td>No data available</td>
</tr>
<tr>
<td>c) Odour Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d) pH</td>
<td>No data available</td>
</tr>
<tr>
<td>e) Melting point/freezing point</td>
<td>Melting point/range: -91 °C (-132 °F)</td>
</tr>
<tr>
<td>f) Initial boiling point and boiling range</td>
<td>98 °C (208 °F)</td>
</tr>
<tr>
<td>g) Flash point</td>
<td>-3.99 °C (24.82 °F) - closed cup</td>
</tr>
<tr>
<td>h) Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>i) Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>j) Upper/lower flammability or explosive limits</td>
<td>Upper explosion limit: 7 % (V)</td>
</tr>
<tr>
<td>k) Vapour pressure</td>
<td>110.7 hPa (83.0 mmHg) at 37.7 °C (99.9 °F)</td>
</tr>
<tr>
<td></td>
<td>53.3 hPa (40.0 mmHg) at 20.0 °C (68.0 °F)</td>
</tr>
<tr>
<td>l) Vapour density</td>
<td>No data available</td>
</tr>
</tbody>
</table>
m) Relative density 0.684 g/mL at 25 °C (77 °F)
n) Water solubility insoluble
o) Partition coefficient: n-octanol/water log Pow: > 3.000
p) Auto-ignition temperature 223.0 °C (433.4 °F)
q) Decomposition temperature No data available
r) Viscosity No data available
s) Explosive properties No data available
t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY
10.1 Reactivity
No data available
10.2 Chemical stability
Stable under recommended storage conditions.
10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.
10.4 Conditions to avoid
Heat, flames and sparks.
10.5 Incompatible materials
Strong oxidizing agents
10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION
11.1 Information on toxicological effects
Acute toxicity
No data available
LC50 Inhalation - Rat - 4 h - 103,000 mg/m3
Inhalation: Irritating to respiratory system.
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available
Carcinogenicity
This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: MI7700000
Prolonged or repeated exposure to skin causes defatting and dermatitis., Central nervous system depression, narcosis, Damage to the lungs.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
LC50 - Carassius auratus (goldfish) - 4 mg/l - 24.0 h
LC50 - Tilapia mossambica - 375 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 1.50 mg/l - 48 h

12.2 Persistence and degradability
Ratio BOD/ThBOD 3.5 %

12.3 Bioaccumulative potential
Indication of bioaccumulation.

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.
Do not empty into drains. Avoid release to the environment.
13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1206  Class: 3  Packing group: II
Proper shipping name: Heptanes
Reportable Quantity (RQ): Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 1206  Class: 3  Packing group: II
Proper shipping name: HEPTANES
Marine pollutant:yes
EMS-No: F-E, S-D

IATA
UN number: 1206  Class: 3  Packing group: II
Proper shipping name: Heptanes

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane</td>
<td>142-82-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane</td>
<td>142-82-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptane</td>
<td>142-82-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

<table>
<thead>
<tr>
<th>Acute aquatic toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute</td>
</tr>
<tr>
<td>Aquatic Chronic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chronic aquatic toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute</td>
</tr>
<tr>
<td>Aquatic Chronic</td>
</tr>
</tbody>
</table>
Asp. Tox.  Aspiration hazard
Flam. Liq.  Flammable liquids
H225  Highly flammable liquid and vapour.
H304  May be fatal if swallowed and enters airways.
H315  Causes skin irritation.
H336  May cause drowsiness or dizziness.
H400  Very toxic to aquatic life.
H410  Very toxic to aquatic life with long lasting effects.
Skin Irrit.  Skin irritation

HMIS Rating
Health hazard:  2
Chronic Health Hazard:  *
Flammability:  3
Physical Hazard  0

NFPA Rating
Health hazard:  2
Fire Hazard:  3
Reactivity Hazard:  0

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.7  Revision Date: 11/03/2015  Print Date: 02/18/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Hexachlorobenzene
Product Number: 171050
Brand: Aldrich
Index-No.: 602-065-00-6
CAS-No.: 118-74-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - repeated exposure, Oral (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H350: May cause cancer.
H372: Causes damage to organs through prolonged or repeated exposure if swallowed.
H410: Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P260: Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264: Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P391 Collect spillage.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>Molecular weight</th>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C}_6\text{Cl}_6 )</td>
<td>284.78 g/mol</td>
<td>118-74-1</td>
<td>204-273-9</td>
<td>602-065-00-6</td>
</tr>
</tbody>
</table>

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexachlorobenzene</td>
<td>Carc. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H350, H372, H410</td>
<td>( \leq 100 % )</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Keep in a dry place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexachlorobenzene</td>
<td>118-74-1</td>
<td>TWA</td>
<td>0.002000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Porphyrin effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Skin damage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Confirmed animal carcinogen with unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>relevance to humans</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Danger of cutaneous absorption</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: powder
   Colour: white

b) Odour
   No data available

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: 227 - 229 °C (441 - 444 °F) - lit.

f) Initial boiling point and boiling range
   323 - 326 °C (613 - 619 °F) - lit.

g) Flash point
   No data available

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   No data available

k) Vapour pressure
   No data available

l) Vapour density
   No data available
m) Relative density No data available
n) Water solubility No data available
o) Partition coefficient: n-octanol/water No data available
p) Auto-ignition temperature No data available
q) Decomposition temperature No data available
r) Viscosity No data available
s) Explosive properties No data available
t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 10,000 mg/kg
LD50 Oral - Mouse - 4,000 mg/kg
LD50 Oral - Cat - 1,700 mg/kg
LD50 Oral - Rabbit - 2,600 mg/kg
LD50 Oral - Guinea pig - > 3,000 mg/kg
LD50 Oral - Quail - > 6,400 mg/kg
LD50 Oral - Mammal - > 5,000 mg/kg

LC50 Inhalation - Rat - 3,600 mg/m3
LC50 Inhalation - Mouse - 4,000 mg/m3
LC50 Inhalation - Cat - 1,600 mg/m3
LC50 Inhalation - Rabbit - 1,800 mg/m3
Dermal: No data available

No data available
Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
Causes photosensitivity. Exposure to light can result in allergic reactions resulting in dermatologic lesions, which can vary from sunburnlike responses to edematous, vesiculated lesions, or bullae

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.
Possible human carcinogen

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Hexachlorobenzene)
NTP: Reasonably anticipated to be a human carcinogen (Hexachlorobenzene)
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: Not available
Liver -

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish
LC50 - Lepomis macrochirus (Bluegill) - 7.6 mg/l - 96.0 h
NOEC - Pimephales promelas (fathead minnow) - > 0.0048 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates
Immobilization EC50 - Daphnia magna (Water flea) - > 0.005 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation
Pimephales promelas (fathead minnow) - 32 d - 0.0003 mg/l
Bioconcentration factor (BCF): 22,000

12.4 Mobility in soil
No data available
12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2729 Class: 6.1 Packing group: III
Proper shipping name: Hexachlorobenzene
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 2729 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: HEXACHLOROBENZENE
Marine pollutant: yes

IATA
UN number: 2729 Class: 6.1 Packing group: III
Proper shipping name: Hexachlorobenzene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components
Hexachlorobenzene CAS-No. 118-74-1 Revision Date 2007-07-01

Pennsylvania Right To Know Components
Hexachlorobenzene CAS-No. 118-74-1 Revision Date 2007-07-01

New Jersey Right To Know Components
Hexachlorobenzene CAS-No. 118-74-1 Revision Date 2007-07-01

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.
Hexachlorobenzene CAS-No. 118-74-1 Revision Date 2007-09-28

WARNING: This product contains a chemical known to the
16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- Aquatic Acute: Acute aquatic toxicity
- Aquatic Chronic: Chronic aquatic toxicity
- Carc.: Carcinogenicity
- H350: May cause cancer.
- H372: Causes damage to organs through prolonged or repeated exposure if swallowed.
- H400: Very toxic to aquatic life.
- H410: Very toxic to aquatic life with long lasting effects.

**HMIS Rating**
- Health hazard: 3
- Chronic Health Hazard: *
- Flammability: 0
- Physical Hazard: 0

**NFPA Rating**
- Health hazard: 3
- Fire Hazard: 0
- Reactivity Hazard: 0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a
guide. The information in this document is based on the present state of our knowledge and is applicable to the
product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the
product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling
or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing
slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.8 Revision Date: 04/24/2015 Print Date: 04/01/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: 1,4-Diethylbenzene

Product Number: D91004
Brand: Aldrich
CAS-No.: 105-05-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 3), H226
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H226 Flammable liquid and vapour.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Call a POISON CENTER or doctor/ physician if you feel unwell.
Specific treatment (see supplemental first aid instructions on this label).
If skin irritation occurs: Get medical advice/ attention.
If eye irritation persists: Get medical advice/ attention.
Take off contaminated clothing and wash before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Diethylbenzene</td>
<td>Flam. Liq. 3; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H226, H315, H319, H335</td>
<td>-</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 30 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Impervious clothing, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: clear, liquid
   Colour: colourless
b) Odour
   No data available
c) Odour Threshold
   No data available
d) pH
   No data available
e) Melting point/freezing point
   Melting point/range: -43 °C (-45 °F) - lit.
f) Initial boiling point and boiling range
   184 °C (363 °F) - lit.
g) Flash point
   55 °C (131 °F) - closed cup
h) Evaporation rate
   No data available
i) Flammability (solid, gas)
   No data available
j) Upper/lower flammability or
explosive limits

k) Vapour pressure no data available

l) Vapour density 4.63 - (Air = 1.0)

m) Relative density 0.862 g/cm3 at 25 °C (77 °F)

n) Water solubility no data available

o) Partition coefficient: n-octanol/water no data available

p) Auto-ignition temperature no data available

q) Decomposition temperature no data available

r) Viscosity no data available

s) Explosive properties no data available

t) Oxidizing properties no data available

9.2 Other safety information

Relative vapour density 4.63 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions no data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity no data available
Dermal: no data available

Skin corrosion/irritation no data available

Serious eye damage/eye irritation no data available

Respiratory or skin sensitisation no data available

Germ cell mutagenicity no data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: Not available
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2049    Class: 3    Packing group: III
Proper shipping name: Diethylbenzene
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2049    Class: 3    Packing group: III    EMS-No: F-E, S-D
Proper shipping name: DIETHYLBENZENE
Marine pollutant: No

IATA
UN number: 2049    Class: 3    Packing group: III
Proper shipping name: Diethylbenzene

15. REGULATORY INFORMATION

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Diethylbenzene</td>
<td>105-05-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Diethylbenzene</td>
<td>105-05-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Diethylbenzene</td>
<td>105-05-5</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.
Eye irritation

Flam. Liq.
Flammable liquids

H226
Flammable liquid and vapour.

H315
Causes skin irritation.

H319
Causes serious eye irritation.

H335
May cause respiratory irritation.

Skin Irrit.
Skin irritation

STOT SE
Specific target organ toxicity - single exposure

HMIS Rating
Health hazard: 2
Chronic Health Hazard: *
Flammability: 2
Physical Hazard: 0

NFPA Rating
Health hazard: 2
Fire Hazard: 2
Reactivity Hazard: 0

Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.2 Revision Date: 07/09/2014 Print Date: 04/20/2016
Safety data for indeno[1,2,3-cd]pyrene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,10-(1,2-phenylene)pyrene, 1,10-(o-phenylene)pyrene, o-phenylene-pyrene, 2,3-phenylene-pyrene, 2,3,o-phenylene-pyrene, IP
Use:
Molecular formula: C_{22}H_{12}
CAS No: 193-39-5
EINECS No: 205-893-2

Physical data

Appearance: solid
Melting point: 161 - 163 °C
Boiling point: 536 °C
Vapour density:
Vapour pressure:
Density (g cm⁻³):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Limited evidence that this material may be carcinogenic.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)
Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R40.

Transport information
(The meaning of any UN hazard codes which appear in this section is given here.)
Non-hazardous for air, sea and road freight.

Personal protection
Treat as potentially hazardous - many multi-ring aromatic compounds are suspected carcinogens.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S36 S37 S45.

This information was last updated on May 10, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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Material Safety Data Sheet
Iron Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Iron Metal
Catalog Codes: SLI2047, SLI1996
CAS#: 7439-89-6
RTECS: NO4565500
TSCA: TSCA 8(b) inventory: Iron Metal
CI#: Not applicable.
Synonym:
Chemical Name: Iron
Chemical Formula: Fe

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Metal, powder</td>
<td>7439-89-6</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Not applicable.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin Contact: Wash with soap and water. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

---

**Section 5: Fire and Explosion Data**

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.


Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.

Special Remarks on Explosion Hazards: Material in powdered form can explode when exposed to heat or flame

---

**Section 6: Accidental Release Measures**

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

---

**Section 7: Handling and Storage**

Precautions:
Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.
**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area. Moisture sensitive.

### Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:** Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:** Not available.

### Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Solid metallic powder.)

**Odor:** Odorless.

**Taste:** Tasteless.

**Molecular Weight:** 55.85 g/mole

**Color:** Black to Grey.

**pH (1% soln/water):** Not applicable.

**Boiling Point:** 3000°C (5432°F)

**Melting Point:** 1535°C (2795°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Density: 7.86 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water, hot water, diethyl ether.

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, ignition sources, incompatible materials, water/moisture, air, dust generation.
Incompatibility with various substances:
Reactive with oxidizing agents, acids. Slightly reactive to reactive with moisture.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Hot iron(wire) burns in Chlorine gas. Violent decomposition of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron. Readily oxidizes in moist air forming rust. Reactive with halogens. Incompatible with acetaldehyde, ammonium peroxosulfate, chloroformaminidum, chloric acid, ammonium nitrate, dinitrogen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide. Readily attacked by dilute mineral acids and or attacked or dissolved by organic acids. Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.
Toxicity to Animals: Acute oral toxicity (LD50): 30000 mg/kg [Rat].
Chronic Effects on Humans: May cause damage to the following organs: liver, cardiovascular system, upper respiratory tract, pancreas.
Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Special Remarks on Toxicity to Animals: Not available.
Special Remarks on Chronic Effects on Humans: Not available.
Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Iron metal filings or dust: May cause skin irritation by mechanical action. Iron metal wire: Not likely to cause skin irritation Eyes: Iron metal filings or dust: Can irritate eyes by mechanical action. Iron metal wire: No hazard. Will not cause eye irritation. Inhalation: Iron dust: Can irritate the respiratory tract by mechanical action. Iron metal wire or filings: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Iron metal wire: Not an ingestion hazard: Iron metal filings or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity. Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulaopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours postingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develop in severe cases of iron intoxication. Chronic Potential Health Effects: Inhalation: Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called SIDEROSIS, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs. Ingestion: Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similar effects were also seen in iron deficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI). Skin: Prolonged or repeated contact may cause hypersensitivity.

Section 12: Ecological Information

Ecotoxicity: Not available.
BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

---

**Section 13: Disposal Considerations**

**Waste Disposal:**
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

---

**Section 14: Transport Information**

**DOT Classification:** CLASS 4.1: Flammable solid.

**Identification:** Metal powder, flammable, n.o.s. (Iron metal powder) UNNA: 3089 PG: III

**Special Provisions for Transport:** Not available.

---

**Section 15: Other Regulatory Information**

**Federal and State Regulations:**
California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal

**Other Regulations:** EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**
WHMIS (Canada): CLASS B-4: Flammable solid.

**DSCL (EEC):**
R11- Highly flammable. S16- Keep away from sources of ignition - No smoking. S22- Do not breathe dust.

**HMIS (U.S.A.):**
- Health Hazard: 1
- Fire Hazard: 2
- Reactivity: 1

**Personal Protection:** E

**National Fire Protection Association (U.S.A.):**
- Health: 1
- Flammability: 2
- Reactivity: 1

**Specific hazard:**

**Protective Equipment:**
Gloves Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

---

**Section 16: Other Information**
References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:52 PM

Last Updated: 11/06/2008 12:00 PM

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1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Isopropyl alcohol
Product Number: W292907
Brand: Aldrich
Index-No.: 603-117-00-0
CAS-No.: 67-63-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H225: Highly flammable liquid and vapour.
H319: Causes serious eye irritation.
H336: May cause drowsiness or dizziness.

Precautionary statement(s)
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.
P261: Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 Call a POISON CENTER or doctor/ physician if you feel unwell.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

<table>
<thead>
<tr>
<th>Substance</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-Propanol</td>
</tr>
<tr>
<td></td>
<td>sec-Propyl alcohol</td>
</tr>
<tr>
<td></td>
<td>Isopropyl alcohol</td>
</tr>
<tr>
<td></td>
<td>Isopropanol</td>
</tr>
</tbody>
</table>

| Formula          | C₃H₈O                   |
| Molecular weight | 60.10 g/mol             |
| CAS-No.          | 67-63-0                 |
| EC-No.           | 200-661-7               |
| Index-No.        | 603-117-00-0            |

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>Flam. Liq. 2; Eye Irrit. 2A; STOT SE 3; H225, H319, H336</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Move out of dangerous area. Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.
Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES
5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES
6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE
7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment. Keep away from sources of ignition. No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Handle and store under inert gas. Hygroscopic

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>TWA</td>
<td>200.000000 ppm</td>
<td>USA, ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks Central Nervous System impairment
Upper Respiratory Tract irritation
Eye irritation
Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
Not classifiable as a human carcinogen

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>200 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Central Nervous System impairment
Upper Respiratory Tract irritation
Eye irritation
Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
Not classifiable as a human carcinogen

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEL</td>
<td>400 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Central Nervous System impairment
Upper Respiratory Tract irritation
Eye irritation
Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
Not classifiable as a human carcinogen

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEL</td>
<td>400.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
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</tbody>
</table>

Central Nervous System impairment
Upper Respiratory Tract irritation
Eye irritation
Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
Not classifiable as a human carcinogen

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>400.000000 ppm 980.000000 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

The value in mg/m3 is approximate.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td>400.000000 ppm 980.000000 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>ST</td>
<td>500.000000 ppm 1,225.000000 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

**Biological occupational exposure limits**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>Acetone</td>
<td>40.0000 mg/l</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
</tr>
</tbody>
</table>

**Remarks**

End of shift at end of workweek

**8.2 Exposure controls**

**Appropriate engineering controls**

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Full contact**
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

**Splash contact**
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 60 min
Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Impervious clothing, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

a) Appearance
   - Form: liquid
   - Colour: colourless

b) Odour
   - Alcohol-like

c) Odour Threshold
   - No data available

d) pH
   - No data available

e) Melting point/freezing point
   - Melting point/range: -89.5 °C (-129.1 °F) - lit.

f) Initial boiling point and boiling range
   - 82 °C (180 °F) - lit.

g) Flash point
   - 12.0 °C (53.6 °F) - closed cup

h) Evaporation rate
   - 3.0

i) Flammability (solid, gas)
   - No data available

j) Upper/lower flammability or
   - Upper explosion limit: 12.7 % (V)
   - Lower explosion limit: 2 % (V)
explosive limits

k) Vapour pressure
   43.2 hPa (32.4 mmHg) at 20.0 °C (68.0 °F)
   58.7 hPa (44.0 mmHg) at 25.0 °C (77.0 °F)

l) Vapour density
   No data available

m) Relative density
   0.785 g/cm3 at 25 °C (77 °F)

n) Water solubility
   completely soluble

o) Partition coefficient: n-octanol/water
   log Pow: 0.05

p) Auto-ignition temperature
   425.0 °C (797.0 °F)

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information

Surface tension
   20.8 mN/m at 25.0 °C (77.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   Vapours may form explosive mixture with air.

10.4 Conditions to avoid
   Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials
   Oxidizing agents, Acid anhydrides, Aluminium, Halogenated compounds, Acids

10.6 Hazardous decomposition products
   Other decomposition products - No data available
   In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
   LD50 Oral - Rat - 5,045 mg/kg
   LC50 Inhalation - Rat - 8 h - 16000 ppm
   LD50 Dermal - Rabbit - 12,800 mg/kg
   No data available

Skin corrosion/irritation
   Skin - Rabbit
   Result: Mild skin irritation

Aldrich - W292907
Serious eye damage/eye irritation
Eyes - Rabbit
Result: Eye irritation - 24 h

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (2-Propanol)
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
Inhalation, Oral - May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: NT8050000
Central nervous system depression, prolonged or repeated exposure can cause: Nausea, Headache, Vomiting, narcosis, Drowsiness, Overexposure may cause mild, reversible liver effects., Aspiration may lead to: Lung oedema, Pneumonia
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Kidney - Irregularities - Based on Human Evidence
Kidney - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - Pimephales promelas (fathead minnow) - 9,640.00 mg/l - 96 h
Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 5,102.00 mg/l - 24 h
other aquatic immobilization EC50 - Daphnia magna (Water flea) - 6,851 mg/l - 24 h
invertebrates
Toxicity to algae EC50 - Desmodesmus subspicatus (green algae) - > 2,000.00 mg/l - 72 h
EC50 - Algae - > 1,000.00 mg/l - 24 h

12.2 Persistence and degradability
No data available
12.3 Bioaccumulative potential
No bioaccumulation is to be expected (log Pow <= 4).

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

**Product**
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging**
Dispose of as unused product.

14. TRANSPORT INFORMATION

**DOT (US)**
- UN number: 1219  Class: 3  Packing group: II
- Proper shipping name: Isopropanol
- Reportable Quantity (RQ):
- Poison Inhalation Hazard: No

**IMDG**
- UN number: 1219  Class: 3  Packing group: II
- Proper shipping name: ISOPROPNOL
- EMS-No: F-E, S-D

**IATA**
- UN number: 1219  Class: 3  Packing group: II
- Proper shipping name: Isopropanol

15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>1987-01-01</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazards**
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>1987-01-01</td>
</tr>
</tbody>
</table>

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>1987-01-01</td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Propanol</td>
<td>67-63-0</td>
<td>1987-01-01</td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.  Eye irritation
Flam. Liq.  Flammable liquids
H225  Highly flammable liquid and vapour.
H319  Causes serious eye irritation.
H336  May cause drowsiness or dizziness.
STOT SE  Specific target organ toxicity - single exposure

HMIS Rating
Health hazard:  2
Chronic Health Hazard:  *
Flammability:  3
Physical Hazard  0

NFPA Rating
Health hazard:  2
Fire Hazard:  3
Reactivity Hazard:  0

Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8  Revision Date: 03/06/2015  Print Date: 02/18/2016
Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead
Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834
CAS#: 7439-92-1
RTECS: OF7525000
TSCA: TSCA 8(b) inventory: Lead
CI#: Not available.
Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot
Chemical Name: Lead
Chemical Formula: Pb

Contact Information:
Scienclab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>7439-92-1</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

**Skin Contact:** Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

**Serious Skin Contact:** Not available.

**Inhalation:**
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

---

### Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Non-flammable in presence of open flames and sparks, of shocks, of heat.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:** When heated to decomposition it emits highly toxic fumes of lead.

**Special Remarks on Explosion Hazards:** Not available.

---

### Section 6: Accidental Release Measures

**Small Spill:**
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

---

### Section 7: Handling and Storage

**Precautions:**
Keep locked up. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable...
protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area.

---

### Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:** Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada] Consult local authorities for acceptable exposure limits.

---

### Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Metal solid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 207.21 g/mole

**Color:** Bluish-white. Silvery. Gray

**pH (1% soln/water):** Not applicable.

**Boiling Point:** 1740°C (3164°F)

**Melting Point:** 327.43°C (621.4°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 11.3 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatile:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water.

---

### Section 10: Stability and Reactivity Data
Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Incompatible materials, excess heat
Incompatibility with various substances: Reactive with oxidizing agents.
Corrosivity: Non-corrosive in presence of glass.
Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.
Special Remarks on Corrosivity: Not available.
Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.
Toxicity to Animals:
LD50: Not available. LC50: Not available.
Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).
Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Special Remarks on Toxicity to Animals: Not available.
Special Remarks on Chronic Effects on Humans: Not available.
Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually absorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, delirium, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.
BOD5 and COD: Not available.
**Products of Biodegradation:**
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

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**Section 13: Disposal Considerations**

**Waste Disposal:**
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

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**Section 14: Transport Information**

**DOT Classification:** Not a DOT controlled material (United States).

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

---

**Section 15: Other Regulatory Information**

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

**Other Regulations:**

**Other Classifications:**
WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):
Health Hazard: 1
Fire Hazard: 0
Reactivity: 0
Personal Protection: E

National Fire Protection Association (U.S.A.):
Health: 1
Flammability: 0
Reactivity: 0
Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.
Other Special Considerations: Not available.
Created: 10/10/2005 08:21 PM
Last Updated: 11/06/2008 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Manganese
Product Number: 463728
Brand: Aldrich
CAS-No.: 7439-96-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H260 In contact with water releases flammable gases which may ignite spontaneously.
H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)
P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232 Handle under inert gas. Protect from moisture.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P335 + P334 Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
P370 + P378  In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404  Store in a dry place. Store in a closed container.
P501  Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula: Mn
Molecular weight: 54.94 g/mol
CAS-No.: 7439-96-5
EC-No.: 231-105-1

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese</td>
<td>Water-react. 1; Aquatic Acute 3; Aquatic Chronic 3; H260, H412</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Dry powder Carbon dioxide (CO2)

Unsuitable extinguishing media
Water

5.2 Special hazards arising from the substance or mixture
Manganese/manganese oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.

Moisture sensitive. Keep in a dry place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
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8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Body Protection**
impervious clothing, Flame retardant protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Data</th>
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</thead>
</table>
| a) Appearance | Form: powder  
Colour: grey |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: 1,244 °C (2,271 °F) - lit. |
| f) Initial boiling point and boiling range | 1,962 °C (3,564 °F) - lit. |
| g) Flash point | Not applicable |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | No data available |
| l) Vapour density | No data available |
| m) Relative density | 7.3 g/mL at 25 °C (77 °F) |
| n) Water solubility | No data available |
| o) Partition coefficient: n-octanol/water | No data available |
| p) Auto-ignition temperature | No data available |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | No data available |
| t) Oxidizing properties | No data available |

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.
10.3 **Possibility of hazardous reactions**
Reacts violently with water.

10.4 **Conditions to avoid**
Exposure to moisture

10.5 **Incompatible materials**
acids, Halogens, Bases, Phosphorus, Sulphur oxides, Peroxides

10.6 **Hazardous decomposition products**
Other decomposition products - No data available
In the event of fire: see section 5

11. **TOXICOLOGICAL INFORMATION**

11.1 **Information on toxicological effects**

   **Acute toxicity**
   LD50 Oral - Rat - 9,000 mg/kg
   Inhalation: No data available
   Dermal: No data available
   No data available

   **Skin corrosion/irritation**
   Skin - Rabbit
   Result: Mild skin irritation - 24 h

   **Serious eye damage/eye irritation**
   Eyes - Rabbit
   Result: Mild eye irritation - 24 h

   **Respiratory or skin sensitisation**
   No data available

   **Germ cell mutagenicity**
   No data available

   **Carcinogenicity**
   Carcinogenicity - Rat - Intramuscular
   Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic:Tumors at site or application.
   
   IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
   
   ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
   
   NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
   
   OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

   **Reproductive toxicity**
   No data available
   May cause reproductive disorders.

   **Specific target organ toxicity - single exposure**
   No data available

   **Specific target organ toxicity - repeated exposure**
   No data available

   **Aspiration hazard**
   No data available
Men exposed to manganese dusts showed a decrease in fertility. Chronic manganese poisoning primarily involves the central nervous system. Early symptoms include languor, sleepiness and weakness in the legs. A stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter and a spastic gait with tendency to fall in walking are findings in more advanced cases. High incidence of pneumonia has been found in workers exposed to the dust or fume of some manganese compounds.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 40 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3208 Class: 4.3 Packing group: I
Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)

Poison Inhalation Hazard: No

IMDG
UN number: 3208 Class: 4.3 Packing group: I EMS-No: F-G, S-N
Proper shipping name: METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S. (Manganese)

IATA
UN number: 3208 Class: 4.3 Packing group: I
Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)
IATA Passenger: Not permitted for transport
15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

<table>
<thead>
<tr>
<th>Component</th>
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<tbody>
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SARA 311/312 Hazards
Reactivity Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

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Pennsylvania Right To Know Components

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New Jersey Right To Know Components

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California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute: Acute aquatic toxicity
Aquatic Chronic: Chronic aquatic toxicity
H260: In contact with water releases flammable gases which may ignite spontaneously.
H402: Harmful to aquatic life.
H412: Harmful to aquatic life with long lasting effects.

HMIS Rating
- Health hazard: 0
- Chronic Health Hazard: *
- Flammability: 3
- Physical Hazard: 2

NFPA Rating
- Health hazard: 0
- Fire Hazard: 0
- Reactivity Hazard: 2
- Special hazard.I: W

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Manganese
Product Number: 463728
Brand: Aldrich
CAS-No.: 7439-96-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger
Hazard statement(s)
H260 In contact with water releases flammable gases which may ignite spontaneously.
H412 Harmful to aquatic life with long lasting effects.
Precautionary statement(s)
P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232 Handle under inert gas. Protect from moisture.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P335 + P334 Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
P370 + P378  In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404  Store in a dry place. Store in a closed container.
P501  Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula: Mn
Molecular weight: 54.94 g/mol
CAS-No.: 7439-96-5
EC-No.: 231-105-1

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese</td>
<td>Water-react. 1; Aquatic Acute 3; Aquatic Chronic 3; H260, H412</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures
General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Dry powder Carbon dioxide (CO2)

Unsuitable extinguishing media
Water

5.2 Special hazards arising from the substance or mixture
Manganese/manganese oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Never allow product to get in contact with water during storage.
Moisture sensitive. Keep in a dry place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
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<tbody>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>TWA</td>
<td>0.200000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks
- Central Nervous System impairment
- Adopted values or notations enclosed are those for which changes are proposed in the NIC
- See Notice of Intended Changes (NIC)

C 5 mg/m³  USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Ceiling limit is to be determined from breathing-zone air samples.

C 5.000000 mg/m³  USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Ceiling limit is to be determined from breathing-zone air samples.
<table>
<thead>
<tr>
<th></th>
<th>TWA</th>
<th>1.000000 mg/m3</th>
<th>USA. NIOSH Recommended Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST</td>
<td>3.000000 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
<td></td>
</tr>
<tr>
<td>TWA</td>
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Central Nervous System impairment

Adopted values or notations enclosed are those for which changes are proposed in the NIC

See Notice of Intended Changes (NIC) varies

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<tr>
<th></th>
<th>TWA</th>
<th>0.100000 mg/m3</th>
<th>USA. ACGIH Threshold Limit Values (TLV)</th>
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Central Nervous System impairment

2014 Adoption varies

<table>
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<th></th>
<th>TWA</th>
<th>0.020000 mg/m3</th>
<th>USA. ACGIH Threshold Limit Values (TLV)</th>
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</table>

Central Nervous System impairment

2014 Adoption varies

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<th></th>
<th>TWA</th>
<th>0.1 mg/m3</th>
<th>USA. ACGIH Threshold Limit Values (TLV)</th>
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Central Nervous System impairment varies

<table>
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<tr>
<th></th>
<th>TWA</th>
<th>0.02 mg/m3</th>
<th>USA. ACGIH Threshold Limit Values (TLV)</th>
</tr>
</thead>
</table>

Central Nervous System impairment varies

### 8.2 Exposure controls

**Appropriate engineering controls**

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

**Body Protection**

impervious clothing, Flame retardant protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

a) Appearance
   - Form: powder
   - Colour: grey

b) Odour
   - No data available

c) Odour Threshold
   - No data available

d) pH
   - No data available

e) Melting point/freezing point
   - Melting point/range: 1,244 °C (2,271 °F) - lit.

f) Initial boiling point and boiling range
   - 1,962 °C (3,564 °F) - lit.

g) Flash point
   - Not applicable

h) Evaporation rate
   - No data available

i) Flammability (solid, gas)
   - No data available

j) Upper/lower flammability or explosive limits
   - No data available

k) Vapour pressure
   - No data available

l) Vapour density
   - No data available

m) Relative density
   - 7.3 g/mL at 25 °C (77 °F)

n) Water solubility
   - No data available

o) Partition coefficient: n-octanol/water
   - No data available

p) Auto-ignition temperature
   - No data available

q) Decomposition temperature
   - No data available

r) Viscosity
   - No data available

s) Explosive properties
   - No data available

t) Oxidizing properties
   - No data available

**9.2 Other safety information**
   - No data available

---

**10. STABILITY AND REACTIVITY**

**10.1 Reactivity**
   - No data available

**10.2 Chemical stability**
   - Stable under recommended storage conditions.
10.3 **Possibility of hazardous reactions**
Reacts violently with water.

10.4 **Conditions to avoid**
Exposure to moisture

10.5 **Incompatible materials**
acids, Halogens, Bases, Phosphorus, Sulphur oxides, Peroxides

10.6 **Hazardous decomposition products**
Other decomposition products - No data available
In the event of fire: see section 5

---

### 11. TOXICOLOGICAL INFORMATION

#### 11.1 Information on toxicological effects

**Acute toxicity**
LD50 Oral - Rat - 9,000 mg/kg
Inhalation: No data available
Dermal: No data available
No data available

**Skin corrosion/irritation**
Skin - Rabbit
Result: Mild skin irritation - 24 h

**Serious eye damage/eye irritation**
Eyes - Rabbit
Result: Mild eye irritation - 24 h

**Respiratory or skin sensitisation**
No data available

**Germ cell mutagenicity**
No data available

**Carcinogenicity**
Carcinogenicity - Rat - Intramuscular
Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Tumorigenic: Tumors at site or application.

- **IARC:** No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- **ACGIH:** No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- **NTP:** No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- **OSHA:** No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available
May cause reproductive disorders.

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available
Additional Information
RTECS: OO9275000

Men exposed to manganese dusts showed a decrease in fertility. Chronic manganese poisoning primarily involves the central nervous system. Early symptoms include languor, sleepiness and weakness in the legs. A stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter and a spastic gait with tendency to fall in walking are findings in more advanced cases. High incidence of pneumonia has been found in workers exposed to the dust or fume of some manganese compounds.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
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EC50 - Daphnia magna (Water flea) - 40 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Harmful to aquatic life.
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3208 Class: 4.3 Packing group: I
Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)

Poison Inhalation Hazard: No

IMDG
UN number: 3208 Class: 4.3 Packing group: I EMS-No: F-G, S-N
Proper shipping name: METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S. (Manganese)

IATA
UN number: 3208 Class: 4.3 Packing group: I
Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)
IATA Passenger: Not permitted for transport
15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

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Reactivity Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

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Pennsylvania Right To Know Components

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California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

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<td>Aquatic Chronic</td>
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<td>In contact with water releases flammable gases which may ignite spontaneously.</td>
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HMIS Rating

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<th>Rating</th>
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<td>Health hazard:</td>
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<tr>
<td>Chronic Health Hazard:</td>
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<td>Flammability:</td>
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<td>Physical Hazard:</td>
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NFPA Rating

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<td>Fire Hazard:</td>
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<td>Reactivity Hazard:</td>
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</tr>
<tr>
<td>Special hazard.I:</td>
<td>W</td>
</tr>
</tbody>
</table>

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
Section 1 - Product and Company Information

Product Name: M-CRESOL APPROX 99%
Product Number: C5015
Brand: SIGMA
Company: Sigma-Aldrich
Address: 3050 Spruce Street
          SAINT LOUIS MO 63103 US
Technical Phone: 800-325-5832
Fax: 800-325-5052
Emergency Phone: 314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name: M-CRESOL
CAS #: 108-39-4
SARA 313: Yes

Formula: C7H8O
Synonyms: 3-Cresol * m-Cresol (ACGIH:OSHA) * m-Cresole *
           m-Cresylic acid * 1-Hydroxy-3-methylbenzene *
           m-Hydroxytoluene * 3-Hydroxytoluene * m-Kresol *
           m-Methylphenol * 3-Methylphenol * m-Oxytoluene *
           Phenol, 3-methyl- (9CI) * RCRA waste number U052 *
           m-Toluol
RTECS Number: GO6125000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Toxic.
Toxic in contact with skin and if swallowed. Causes burns.
Readily absorbed through skin. Combustible. Target organ(s):
Central nervous system. Lungs.

HMIS RATING
HEALTH: 3 *
FLAMMABILITY: 2
REACTIVITY: 1

NFPA RATING
HEALTH: 3
FLAMMABILITY: 2
REACTIVITY: 1

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures
ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately. Do not induce vomiting.

inhaLATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT
186,800 °F  86,000 °C  Method: closed cup

EXPLOSION LIMITS
Lower: 1,060 %  Upper: 1,350 %

AUTOIGNITION TEMP
558,00 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Combustible liquid. Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Cover with dry lime or soda ash, pick up, keep in a closed container, and hold for waste disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Do not get in eyes, on
skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed. Keep away from heat and open flame. Store in a cool dry place.
Unsuitable: May discolor on exposure to air and light.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.
Other: Faceshield (8-inch minimum).

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Discard contaminated shoes. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

<table>
<thead>
<tr>
<th>Country</th>
<th>Source</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>ACGIH</td>
<td>TWA</td>
<td>5 PPM</td>
</tr>
<tr>
<td>Remarks: Skin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>MSHA Standard-air TWA</td>
<td>5 PPM (22 MG/M3)</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>OSHA. PEL</td>
<td>8H TWA 5 PPM (22 MG/M3) (SKIN)</td>
<td></td>
</tr>
<tr>
<td>New Zealand OEL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks: check ACGIH TLV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>NIOSH</td>
<td>TWA</td>
<td>2.3 PPM</td>
</tr>
</tbody>
</table>

Section 9 - Physical/Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>108,1400 AMU</td>
</tr>
<tr>
<td>pH</td>
<td>N/A</td>
</tr>
<tr>
<td>BP/BP Range</td>
<td>200,000. – 203,000 °C.</td>
</tr>
<tr>
<td>MP/MP Range</td>
<td>8,000. – 10,000 °C.</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>N/A</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>&lt; 1,000000000 mmHg</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>3,720 g/l</td>
</tr>
<tr>
<td>Saturated Vapor Conc.</td>
<td>N/A</td>
</tr>
<tr>
<td>SG/Density</td>
<td>1,0340 g/cm3</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>N/A</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>N/A</td>
</tr>
<tr>
<td>Volatile%</td>
<td>N/A</td>
</tr>
<tr>
<td>VOC Content</td>
<td>N/A</td>
</tr>
<tr>
<td>Water Content</td>
<td>N/A</td>
</tr>
<tr>
<td>Solvent Content</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Evaporation Rate: N/A
Viscosity: 12,900 Pas, 25,000 °C
Surface Tension: N/A
Partition Coefficient: N/A
Decomposition Temp.: N/A
Flash Point: 186,800 °F, 86,000 °C
Method: closed cup
Explosion Limits: Lower: 1.060 %, Upper: 1.350 %
Flammability: N/A
Autoignition Temp: 558.00 °C
Refractive Index: 1.5420
Optical Rotation: N/A
Miscellaneous Data: N/A
Solubility: Other Solvents: SOLUBLE IN ACETONE, ETHANOL, MISCIBLE IN ALCOHOL, ETHER

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents, Bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: Causes burns.
Skin Absorption: Toxic if absorbed through skin. Readily absorbed through skin.
Eye Contact: Causes burns.
Inhalation: May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
Ingestion: Toxic if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

SIGNS AND SYMPTOMS OF EXPOSURE
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.
Inhalation may result in spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema.
Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Exposure can cause: Damage to the eyes. Damage to the kidneys. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA
Oral Rat
242,000000 mg/kg
LD50
Behavioral: Convulsions or effect on seizure threshold.
Gastrointestinal: Peritonitis.

Inhalation Rat
> 710,000 mg/m3
LC50

Skin Rat
1100,000000 mg/kg
LD50

Oral Mouse
828,000000 mg/kg
LD50

Intraperitoneal Mouse
168 MG/KG
LD50

Skin Rabbit
2050,000000 mg/kg
LD50
Remarks: Behavioral: Convulsions or effect on seizure threshold.
Sense Organs and Special Senses (Nose, Eye, Ear, and Taste): Eye: Lacrimation. Gastrointestinal: Changes in structure or function of salivary glands.

IRRITATION DATA

Skin Rabbit
517,000000 mg
24H
Remarks: Severe irritation effect

Eyes Rabbit
103,000000 mg
Remarks: Severe irritation effect

CHRONIC EXPOSURE - CARCINOGEN

Species: Mouse
Route of Application: Skin
Dose: 2280 MG/KG
Exposure Time: 20W
Frequency: I
Result: Tumorigenic: Neoplastic by RTECS criteria. Skin and Appendages: Other: Tumors.
CHRONIC EXPOSURE - TERATOGEN

Species: Rabbit  
Dose: 134 GM/KG  
Route of Application: Subcutaneous  
Exposure Time: (6-18D PREG)  
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

CHRONIC EXPOSURE - MUTAGEN

Species: Human  
Dose: 10 UMOL/L  
Exposure Time: 4H  
Cell Type: HeLa cell  
Mutation test: DNA inhibition

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Algae  
Time: 24,0 h  
Value: 110,000 mg/l

Test Type: EC50 Daphnia  
Species: Daphnia magna  
Time: 24,0 h  
Value: 25,000 mg/l

Test Type: LC50 Fish  
Species: Leuciscus idus  
Time: 48,0 h  
Value: 17,000. - 19,000 mg/l.

Test Type: LC50 Fish  
Species: Onchorhynchus mykiss (Rainbow trout)  
Time: 96,0 h  
Value: 8,900 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: Cresols  
UN#: 2076  
Class: 6.1  
Packing Group: Packing Group II  
Hazard Label: Toxic substances.  
Hazard Label: Corrosive  
PIH: Not PIH

IATA

Proper Shipping Name: Cresols, liquid (o-, m-, p-)

SIGMA  www.sigma-aldrich.com
IATA UN Number: 2076  
Hazard Class: 6.1  
Packing Group: II

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T
Indication of Danger: Toxic.
R: 24/25-34
Risk Statements: Toxic in contact with skin and if swallowed. Causes burns.
S: 36/37/39-45
Safety Statements: Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Toxic.
Risk Statements: Toxic in contact with skin and if swallowed. Causes burns.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
Target organ(s): Central nervous system. Lungs.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1,000 %
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2010 Sigma-Aldrich Co. License granted to make unlimitedpaper copies for internal use only.
SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name: Mercury

Product Number: 215457
Brand: SIGALD
Index-No.: 080-001-00-0
CAS-No.: 7439-97-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Scientific research and development, Reagent for analysis

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone: +1 314 771-5765
Fax: +1 800 325-5052

1.4 Emergency telephone

Emergency Phone #: 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word: Danger
Hazard statement(s)
H330 Fatal if inhaled.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284 Wear respiratory protection.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P391 Collect spillage.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>mercury</td>
<td>Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360, H372, H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 100</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.
SECTION 4: First aid measures

4.1 Description of first-aid measures

**General advice**
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

**If inhaled**
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

**In case of skin contact**
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/shower. Consult a physician.

**In case of eye contact**
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

**If swallowed**
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

**Suitable extinguishing media**
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

**Unsuitable extinguishing media**
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Mercury/mercury oxides. Not combustible. Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.
SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. In some instances, a mercury spill kit may be used. Please consult with your site EHS representative to determine the most appropriate clean up method. Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Advice on safe handling
Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Storage conditions
Tightly closed. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.
Store under inert gas.

Storage class
Storage class (TRGS 510): 6.1B: Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters
Ingredients with workplace control parameters
<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>mercury</td>
<td>7439-97-6</td>
<td>C</td>
<td>0.1 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
</tbody>
</table>

Remarks: Potential for dermal absorption

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEIL</td>
<td></td>
<td>1.0 mg/10m3</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-2</td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>0.05 mg/m3</td>
<td></td>
<td>USA. Table Z-1-A Limits for Air Contaminants (1989 vacated values)</td>
</tr>
</tbody>
</table>

Skin notation

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWA</td>
<td></td>
<td>0.025 mg/m3</td>
<td></td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

- Central Nervous System impairment
- Kidney damage
- Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
- Not classifiable as a human carcinogen
- Danger of cutaneous absorption

TWA 0.05 mg/m3 USA. NIOSH Recommended Exposure Limits

Potential for dermal absorption

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L
Body Protection
protective clothing

Respiratory protection
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: liquid
   Color: silver, white

b) Odor
   odorless

c) Odor Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: -38.87 °C (-37.97 °F) - lit.

f) Initial boiling point and boiling range
   356.6 °C 673.9 °F - lit.

g) Flash point
   ()Not applicable

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   The product is not flammable.

j) Upper/lower flammability or explosive limits
   No data available

k) Vapor pressure
   < 0.01 hPa at 20 °C (68 °F)
   1 hPa at 126 °C(259 °F)

l) Vapor density
   6.93 - (Air = 1.0)

m) Density
   13.55 g/cm3 at 25 °C (77 °F)
   Relative density
   No data available

n) Water solubility
   0.00006 g/l at 25 °C (77 °F)

o) Partition coefficient:
   n-octanol/water
   Not applicable for inorganic substances

p) Autoignition temperature
   No data available

q) Decomposition temperature
   No data available

r) Viscosity
   No data available
s) Explosive properties  No data available
t) Oxidizing properties  none

9.2 Other safety information
Relative vapor density  6.93 - (Air = 1.0)

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature).

10.3 Possibility of hazardous reactions
Risk of explosion with:
- Acetylene
- Alkali metals
- Aluminum
- Amines
- Ammonia
- chlorine dioxide
- Potassium
- sodium
- oxalic acid
- perchlorates
Risk of ignition or formation of inflammable gases or vapours with:
- Chlorine
- silanes
- Oxygen
Generates dangerous gases or fumes in contact with:
- Nitric acid
- Exothermic reaction with:
- Bromine
- Metals
- acetylidene
- Oxygen

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Aluminum, Lead, Copper, silver, Zinc, zinc alloys, Tin

10.6 Hazardous decomposition products
In the event of fire: see section 5
SECTION 11: Toxicological information

11.1 Information on toxicological effects

**Acute toxicity**
Oral: No data available
LC50 Inhalation - Rat - male - 2 h - < 27 mg/m3 - vapor

Dermal: No data available

**Skin corrosion/irritation**
No data available

**Serious eye damage/eye irritation**
No data available

**Respiratory or skin sensitization**
No data available

**Germ cell mutagenicity**
No data available

**Carcinogenicity**
This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

**Reproductive toxicity**
Presumed human reproductive toxicant

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
Causes damage to organs through prolonged or repeated exposure.

**Aspiration hazard**
No data available

11.2 Additional Information

RTECS: OV4550000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence
SECTION 12: Ecological information

12.1 Toxicity
Toxicity to fish mortality LC50 - Cyprinus carpio (Carp) - 0.160 mg/l - 96 h
Toxicity to fish (Chronic toxicity) Remarks: No data available (mercury)

12.2 Persistence and degradability
The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential
Bioaccumulation Carassius auratus (goldfish) - 1,789 d
- 0.25 µg/l(mercury)
Bioconcentration factor (BCF): 155,986

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Product
Waste material must be disposed of in accordance with the national and local regulations.
Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: Mercury
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 2809 Class: 8 (6.1) Packing group: III EMS-No: F-A, S-B
Proper shipping name: MERCURY
Marine pollutant: yes

IATA
SIGALD - 215457
**SECTION 15: Regulatory information**

**SARA 302 Components**
This material does not contain any components with a section 302 EHS TPQ.

**SARA 313 Components**
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>mercury</td>
<td>7439-97-6</td>
<td>2015-11-23</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazards**
Acute Health Hazard, Chronic Health Hazard

Reportable Quantity: D009 lbs

**Massachusetts Right To Know Components**
No components are subject to the Massachusetts Right to Know Act.

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>mercury</td>
<td>7439-97-6</td>
<td>2015-11-23</td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**
, which is/are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.mercury

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>mercury</td>
<td>7439-97-6</td>
<td>2013-12-20</td>
</tr>
</tbody>
</table>

**SECTION 16: Other information**

**Further information**
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.
# Methyl chloride (Refrigerant gas R 40)

## Safety Data Sheet

**This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.**

**Date of issue:** 01/01/1980  
**Revision date:** 10/17/2016  
**Supersedes:** 10/14/2015

## SECTION: 1. Product and company identification

### 1.1. Product identifier

<table>
<thead>
<tr>
<th>Product form</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Methyl chloride (Refrigerant gas R 40)</td>
</tr>
<tr>
<td>CAS No</td>
<td>74-87-3</td>
</tr>
<tr>
<td>Formula</td>
<td>CH3Cl</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>methylchloride, halocarbon 40, monochoromethane</td>
</tr>
</tbody>
</table>

### 1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture: Industrial use. Use as directed.

### 1.3. Details of the supplier of the safety data sheet

Praxair, Inc.  
10 Riverview Drive  
Danbury, CT 06810-6268 · USA  
T 1-800-772-9247 (1-800-PRAXAIR) · F 1-716-879-2146  
www.praxair.com

### 1.4. Emergency telephone number

Emergency number: Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week  
— Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887  
(collect calls accepted, Contract 17729)

## SECTION 2: Hazard identification

### 2.1. Classification of the substance or mixture

<table>
<thead>
<tr>
<th>GHS-US classification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flam. Gas 1</td>
<td>H220</td>
</tr>
<tr>
<td>Liquefied gas</td>
<td>H280</td>
</tr>
<tr>
<td>Acute Tox. 4 (Inhalation:gas)</td>
<td>H332</td>
</tr>
<tr>
<td>Carc. 2</td>
<td>H351</td>
</tr>
<tr>
<td>STOT RE 2</td>
<td>H373</td>
</tr>
</tbody>
</table>

### 2.2. Label elements

#### GHS-US labeling

<table>
<thead>
<tr>
<th>Hazard pictograms (GHS-US)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GHS02</td>
<td></td>
</tr>
<tr>
<td>GHS04</td>
<td></td>
</tr>
<tr>
<td>GHS07</td>
<td></td>
</tr>
<tr>
<td>GHS08</td>
<td></td>
</tr>
</tbody>
</table>

**Signal word (GHS-US):** DANGER

**Hazard statements (GHS-US):**

- H220 - EXTREMELY FLAMMABLE GAS
- H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
- H332 - HARMFUL IF INHALED
- H351 - SUSPECTED OF CAUSING CANCER
- H373 - MAY CAUSE DAMAGE TO ORGANS (LUNG, KIDNEYS, LIVER, CENTRAL NERVOUS SYSTEM) THROUGH PROLONGED OR REPEATED EXPOSURE
- CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
- CGA-HG01 - MAY CAUSE FROSTBITE

**Precautionary statements (GHS-US):**

- P201 - Obtain special instructions before use
- P202 - Do not handle until all safety precautions have been read and understood
- P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
- P260 - Do not breathe gas
### Methyl chloride (Refrigerant gas R 40)

**Safety Data Sheet**


**Date of issue:** 01/01/1980  
**Revision date:** 10/17/2016  
**Supersedes:** 10/14/2015

---

**P262**  
Do not get in eyes, on skin, or on clothing

**P271+P403**  
Use and store only outdoors or in a well-ventilated place

**P280+P284**  
Wear protective gloves, protective clothing, eye protection, respiratory protection, and/or face protection

**P377**  
Do not extinguish, unless leak can be stopped safely

**P381**  
Eliminate all ignition sources if safe to do so

**P405**  
Store locked up

**P501**  
Dispose of contents/container in accordance with container Supplier/owner instructions

**CGA-PG05**  
Use a back flow preventive device in the piping

**CGA-PG12**  
Do not open valve until connected to equipment prepared for use

**CGA-PG06**  
Close valve after each use and when empty

**CGA-PG02**  
Protect from sunlight when ambient temperature exceeds 52°C (125°F)

---

**2.3. Other hazards**

Other hazards not contributing to the classification: Contact with liquid may cause cold burns/frostbite.

**2.4. Unknown acute toxicity (GHS US)**

No data available

### SECTION 3: Composition/Information on ingredients

#### 3.1. Substance

<table>
<thead>
<tr>
<th>Name</th>
<th>Product identifier</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl chloride (Refrigerant gas R 40) (Main constituent)</td>
<td>CAS No 74-87-3</td>
<td>100</td>
</tr>
</tbody>
</table>

#### 3.2. Mixture

Not applicable

### SECTION 4: First aid measures

#### 4.1. Description of first aid measures

**First-aid measures after inhalation:** Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

**First-aid measures after skin contact:** The liquid may cause frostbite. For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.

**First-aid measures after eye contact:** Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

**First-aid measures after ingestion:** Ingestion is not considered a potential route of exposure.

#### 4.2. Most important symptoms and effects, both acute and delayed

No additional information available

#### 4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

### SECTION 5: Firefighting measures

#### 5.1. Extinguishing media

Suitable extinguishing media: Carbon dioxide, Dry chemical, Water spray or fog. Use extinguishing media appropriate for surrounding fire.

#### 5.2. Special hazards arising from the substance or mixture

**Fire hazard:** EXTREMELY FLAMMABLE GAS. If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.
Explosion hazard: EXTREMELY FLAMMABLE GAS. Forms explosive mixtures with air and oxidizing agents.

Reactivity: No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions: DANGER! Toxic, flammable liquefied gas

Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Special protective equipment for fire fighters: Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

Other information: Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures: DANGER: Flammable, liquefied gas. FORMS EXPLOSIVE MIXTURES WITH AIR. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use, keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.
Methyl chloride (Refrigerant gas R 40)

Safety Data Sheet P-4622


Date of issue: 01/01/1980   Revision date: 10/17/2016   Supersedes: 10/14/2015

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions: Store only where temperature will not exceed 125°F (52°C). Post “No Smoking/No Open Flames” signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g., NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Methyl chloride (Refrigerant gas R 40) (74-87-3)

<table>
<thead>
<tr>
<th>Safety Standard</th>
<th>Parameter</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH TLV-TWA</td>
<td>ppm</td>
<td>50</td>
</tr>
<tr>
<td>ACGIH TLV-STEL</td>
<td>ppm</td>
<td>100</td>
</tr>
<tr>
<td>OSHA PEL (TWA)</td>
<td>ppm</td>
<td>100</td>
</tr>
<tr>
<td>OSHA PEL (Ceiling)</td>
<td>ppm</td>
<td>200</td>
</tr>
<tr>
<td>US IDLH</td>
<td>mg/m³</td>
<td>≈ mg/m³</td>
</tr>
<tr>
<td>US IDLH</td>
<td>ppm</td>
<td>2000</td>
</tr>
</tbody>
</table>

8.2. Exposure controls

Appropriate engineering controls: Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): Inadequate - Use only in a closed system. Use explosion proof equipment and lighting. A canopy-type, forced-draft fume hood is preferred.

Eye protection: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133.

Skin and body protection: Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Respiratory protection: When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Thermal hazard protection: Wear cold insulating gloves when transferring or breaking transfer connections.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state: Gas

Appearance: Colorless gas.

Molecular mass: 50.5 g/mol

Color: Colorless.
Methyl chloride (Refrigerant gas R 40)
Safety Data Sheet

Odor threshold: < 0.01 ppm
pH: Not applicable.
Relative evaporation rate (butyl acetate=1): Not applicable.
Relative evaporation rate (ether=1): No data available
Melting point: -97.7 °C (-143.86°F)
Freezing point: No data available
Boiling point: -24.2 °C (-11.6°F)
Flash point: Not applicable.
Critical temperature: 143.1 °C (289.6°F)
Auto-ignition temperature: 632 °C (1170°F)
Decomposition temperature: No data available
Flammability (solid, gas): 8.1 - 17.4 vol %
Vapor pressure: 5.1 bar (73.4 psia) (@21.1°C/70°F)
Critical pressure: 66.5 bar (966 psia)
Relative vapor density at 20 °C: No data available
Relative density: 0.92 ( at 20°C/68°F)
Density: 0.921 g/cm³ (at 20 °C)
Relative gas density: 1.743 (at 21.1°C/70°F, 1 atm)
Solubility: Water: 6310 mg/l
Log Pow: 0.91
Log Kow: Not applicable.
Viscosity, kinematic: Not applicable.
Viscosity, dynamic: Not applicable.
Explosive properties: Not applicable.
Oxidizing properties: None.
Explosion limits: No data available

9.2. Other information
Gas group: Liquefied gas
Additional information: Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTION 10: Stability and reactivity

10.1. Reactivity
No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability
Stable under normal conditions.

10.3. Possibility of hazardous reactions
May occur.

10.4. Conditions to avoid
Avoid temperature above 752°F (400°C).

10.5. Incompatible materials

10.6. Hazardous decomposition products
SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity: Inhalation: gas: HARMFUL IF INHALED.

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD50 oral rat</td>
<td>1800 mg/kg</td>
</tr>
<tr>
<td>LC50 inhalation rat (mg/l)</td>
<td>5300 mg/m³ (Exposure time: 4 h)</td>
</tr>
<tr>
<td>LC50 inhalation rat (ppm)</td>
<td>8300 ppm/1h</td>
</tr>
<tr>
<td>ATE US (oral)</td>
<td>1800.000 mg/kg body weight</td>
</tr>
<tr>
<td>ATE US (gases)</td>
<td>8300.000 ppm/1h</td>
</tr>
</tbody>
</table>

Skin corrosion/irritation: Not classified

pH: Not applicable.

Serious eye damage/irritation: Not classified

pH: Not applicable.

Respiratory or skin sensitization: Not classified

Germ cell mutagenicity: Not classified

Carcinogenicity: SUSPECTED OF CAUSING CANCER.

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IARC group</td>
<td>3 - Not classifiable</td>
</tr>
</tbody>
</table>

Reproductive toxicity: Not classified

Specific target organ toxicity (single exposure): Not classified

Specific target organ toxicity (repeated exposure): MAY CAUSE DAMAGE TO ORGANS (LUNG, KIDNEYS, LIVER, CENTRAL NERVOUS SYSTEM) THROUGH PROLONGED OR REPEATED EXPOSURE.

Aspiration hazard: Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general: No known ecological damage caused by this product.

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50 fish 1</td>
<td>550 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [static])</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

Persistence and degradability: The substance is biodegradable. Unlikely to persist.

12.3. Bioaccumulative potential

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Pow</td>
<td>0.91</td>
</tr>
<tr>
<td>Log Kow</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Bioaccumulative potential</td>
<td>Not expected to bioaccumulate due to the low log Kow (log Kow &lt; 4). Refer to section 9.</td>
</tr>
</tbody>
</table>

12.4. Mobility in soil

**Methyl chloride (Refrigerant gas R 40) (74-87-3)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility in soil</td>
<td>No data available.</td>
</tr>
<tr>
<td>Ecology - soil</td>
<td>Because of its high volatility, the product is unlikely to cause ground or water pollution.</td>
</tr>
</tbody>
</table>

12.5. Other adverse effects

Other adverse effects: May cause pH changes in aqueous ecological systems.

Effect on ozone layer: None

Global warming potential [CO2=1]: 13

Effect on the global warming: Contains Fluorinated greenhouse gases covered by the Kyoto protocol
### SECTION 13: Disposal considerations

#### 13.1. Waste treatment methods


#### Waste disposal recommendations

Do not attempt to dispose of residual or unused quantities. Return container to supplier.

### SECTION 14: Transport information

In accordance with DOT

| Transport document description | UN1063 Methyl chloride, 2.1 |
| UN-No.(DOT) | UN1063 |
| Proper Shipping Name (DOT) | Methyl chloride |
| Class (DOT) | Flammable gas 49 CFR 173.115 |
| Hazard labels (DOT) | Flammable gas |

DOT Special Provisions (49 CFR 172.102)

N86 - UN pressure receptacles made of aluminum alloy are not authorized.

T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter.

**Additional information**

| Emergency Response Guide (ERG) Number | 115 |
| Other information | No supplementary information available. |
| Special transport precautions | Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted. |

### Transport by sea

| UN-No. (IMDG) | 1063 |
| Proper Shipping Name (IMDG) | METHYL CHLORIDE (REFRIGERANT GAS R 40) |
| Class (IMDG) | Gases |
| MFAG-No | 115 |

### Air transport

| UN-No. (IATA) | 1063 |
| Proper Shipping Name (IATA) | Methyl chloride |
| Class (IATA) | Gases under pressure/Gases flammable under pressure |
## SECTION 15: Regulatory information

### 15.1. US Federal regulations

<table>
<thead>
<tr>
<th>Methyl chloride (Refrigerant gas R 40) (74-87-3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the United States TSCA (Toxic Substances Control Act) inventory</td>
<td></td>
</tr>
<tr>
<td>Subject to reporting requirements of United States SARA Section 313</td>
<td></td>
</tr>
<tr>
<td>CERCLA RQ</td>
<td>100 lb</td>
</tr>
<tr>
<td>SARA Section 311/312 Hazard Classes</td>
<td>Immediate (acute) health hazard</td>
</tr>
<tr>
<td></td>
<td>Delayed (chronic) health hazard</td>
</tr>
<tr>
<td></td>
<td>Sudden release of pressure hazard</td>
</tr>
<tr>
<td></td>
<td>Fire hazard</td>
</tr>
<tr>
<td>SARA Section 313 - Emission Reporting</td>
<td>1.0 %</td>
</tr>
</tbody>
</table>

### 15.2. International regulations

#### CANADA

<table>
<thead>
<tr>
<th>Methyl chloride (Refrigerant gas R 40) (74-87-3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the Canadian DSL (Domestic Substances List)</td>
<td></td>
</tr>
</tbody>
</table>

#### EU-Regulations

<table>
<thead>
<tr>
<th>Methyl chloride (Refrigerant gas R 40) (74-87-3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)</td>
<td></td>
</tr>
</tbody>
</table>

### 15.2.2. National regulations

<table>
<thead>
<tr>
<th>Methyl chloride (Refrigerant gas R 40) (74-87-3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the AICS (Australian Inventory of Chemical Substances)</td>
<td></td>
</tr>
<tr>
<td>Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)</td>
<td></td>
</tr>
<tr>
<td>Listed on the Japanese ENCS (Existing &amp; New Chemical Substances) inventory</td>
<td></td>
</tr>
<tr>
<td>Listed on the Korean ECL (Existing Chemicals List)</td>
<td></td>
</tr>
<tr>
<td>Listed on NZIoC (New Zealand Inventory of Chemicals)</td>
<td></td>
</tr>
<tr>
<td>Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)</td>
<td></td>
</tr>
<tr>
<td>Japanese Poisonous and Deleterious Substances Control Law</td>
<td></td>
</tr>
<tr>
<td>Japanese Pollutant Release and Transfer Register Law (PRTR Law)</td>
<td></td>
</tr>
<tr>
<td>Listed on the Canadian IDL (Ingredient Disclosure List)</td>
<td></td>
</tr>
<tr>
<td>Listed on INSQ (Mexican National Inventory of Chemical Substances)</td>
<td></td>
</tr>
</tbody>
</table>

### 15.3. US State regulations

<table>
<thead>
<tr>
<th>Methyl chloride (Refrigerant gas R 40)(74-87-3)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. - California - Proposition 65 - Carcinogens List</td>
<td>No</td>
</tr>
<tr>
<td>U.S. - California - Proposition 65 - Developmental Toxicity</td>
<td>Yes</td>
</tr>
<tr>
<td>U.S. - California - Proposition 65 - Reproductive Toxicity - Female</td>
<td>No</td>
</tr>
<tr>
<td>U.S. - California - Proposition 65 - Reproductive Toxicity - Male</td>
<td>Yes</td>
</tr>
<tr>
<td>State or local regulations</td>
<td>U.S. - Massachusetts - Right To Know List</td>
</tr>
<tr>
<td></td>
<td>U.S. - New Jersey - Right to Know Hazardous Substance List</td>
</tr>
<tr>
<td></td>
<td>U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List</td>
</tr>
<tr>
<td></td>
<td>U.S. - Pennsylvania - RTK (Right to Know) List</td>
</tr>
</tbody>
</table>
SECTION 16: Other information

Other information: When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product.

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product.

Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc, P.O. Box 44, Tonawanda, NY 14151-0044)

PRAXAIR and the Flowing Airstream design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.

NFPA health hazard: 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.

NFPA fire hazard: 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

NFPA reactivity: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.

HMIS III Rating
Health: 2 Moderate Hazard - Temporary or minor injury may occur
Flammability: 4 Severe Hazard
Physical: 2 Moderate Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.
1. Identification

Product Name: Methylene chloride

Cat No.: D37-1; D37-4; D37-20; D37-200; D37-200LC; D37-500; D37FB-19; D37FB-50; D37FB-115; D37FB-200; D37POP-19; D37POPB-50; D37POPB-200; D37RB-19; D37RB-50; D37RB-115; D37RB-200; D37RS-19; D37RS-28; D37RS-50; D37RS-115; D37RS-200; D37SK-4; D37SK-4LC; D37SS-28; D37SS-50; D37SS-115; D37SS-200; D37SS-1350

Synonyms: Dichloromethane; DCM

Recommended Use: Laboratory chemicals.

Uses advised against: No Information available

Company: Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number: CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification:
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Hazard Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 3</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Target Organs - Central nervous system (CNS), Respiratory system.</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 2</td>
</tr>
<tr>
<td>Target Organs - Liver, Kidney, Blood.</td>
<td>Category 2</td>
</tr>
</tbody>
</table>

Label Elements:

Signal Word: Danger

Hazard Statements:
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>75-09-2</td>
<td>&gt;99.5</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>67-56-1</td>
<td>0 - 0.4</td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>110-83-8</td>
<td>0 - 0.01</td>
</tr>
<tr>
<td>2-Methyl-2-butene</td>
<td>513-35-9</td>
<td>0 - 0.01</td>
</tr>
</tbody>
</table>

4. First-aid measures

General Advice
If symptoms persist, call a physician.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.
**Inhalation**
Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

**Ingestion**
Do not induce vomiting. Call a physician or Poison Control Center immediately.

**Most important symptoms/effects**
Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

**Notes to Physician**
Treat symptomatically

---

**5. Fire-fighting measures**

**Suitable Extinguishing Media**
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**Unsuitable Extinguishing Media**
No information available

**Flash Point**
No information available

**Method**
No information available

**Autoignition Temperature**
556 °C / 1032.8 °F

**Explosion Limits**
- **Upper**: 23 vol %
- **Lower**: 13 vol %

**Sensitivity to Mechanical Impact**
No information available

**Sensitivity to Static Discharge**
No information available

**Specific Hazards Arising from the Chemical**
The thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

**Hazardous Combustion Products**
Carbon monoxide (CO) Carbon dioxide (CO$_2$) Hydrogen chloride gas Phosgene

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

---

**6. Accidental release measures**

**Personal Precautions**
Use personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Keep people away from and upwind of spill/leak.

**Environmental Precautions**
Should not be released into the environment. See Section 12 for additional ecological information.

**Methods for Containment and Clean Up**
Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

---

**7. Handling and storage**

**Handling**
Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Use only under a chemical fume hood.

**Storage**
Keep containers tightly closed in a dry, cool and well-ventilated place.

---

**8. Exposure controls / personal protection**

**Exposure Guidelines**
### 9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl alcohol</td>
<td>TWA: 200 ppm STEL: 250 ppm Skin (Vacated) TWA: 200 ppm (Vacated) TWA: 260 mg/m³ (Vacated) STEL: 250 ppm (Vacated) STEL: 325 mg/m³ Skin TWA: 200 ppm TWA: 260 mg/m³</td>
<td>IDLH: 6000 ppm TWA: 200 ppm TWA: 260 mg/m³ STEL: 250 ppm STEL: 325 mg/m³</td>
<td></td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>TWA: 300 ppm (Vacated) TWA: 300 ppm (Vacated) TWA: 1015 mg/m³ TWA: 300 ppm TWA: 1015 mg/m³</td>
<td>IDLH: 2000 ppm TWA: 300 ppm TWA: 1015 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

**Legend**

ACGIH - American Conference of Governmental Industrial Hygienists  
OSHA - Occupational Safety and Health Administration  
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

### Engineering Measures

Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

### Personal Protective Equipment

**Eye/face Protection**  
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection**  
Wear appropriate protective gloves and clothing to prevent skin exposure.

**Respiratory Protection**  
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

### Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.
Evaporation Rate: No information available
Flammability (solid, gas): Not applicable
Flammability or explosive limits:
- Upper: 23 vol %
- Lower: 13 vol %
Vapor Pressure: 20 mmHg @ 350°C
Vapor Density: 2.93 (Air = 1.0)
Specific Gravity: 1.33
Solubility: No information available
Partition coefficient; n-octanol/water: No data available
Autoignition Temperature: 556 °C / 1032.8 °F
Decomposition Temperature: No information available
Viscosity: No information available
Molecular Formula: C H2 Cl2
Molecular Weight: 84.93

10. Stability and reactivity

Reactive Hazard: None known, based on information available
Stability: Stable under normal conditions.
Conditions to Avoid: Incompatible products. Excess heat.
Incompatible Materials: Strong oxidizing agents, Strong acids, Amines
Hazardous Decomposition Products: Carbon monoxide (CO), Carbon dioxide (CO2), Hydrogen chloride gas, Phosgene
Hazardous Polymerization: Hazardous polymerization does not occur.
Hazardous Reactions: None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral (LD50 Dermal)</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>&gt; 2000 mg/kg (Rat)</td>
<td>&gt; 2000 mg/kg (Rat)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>LD50 = 6200 mg/kg (Rat)</td>
<td>LD50 = 15800 mg/kg (Rabbit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>LD50 = 2400 µL/kg (Rat)</td>
<td>&gt;200 mg/kg (Rat)</td>
</tr>
<tr>
<td>2-Methyl-2-butene</td>
<td>700-2600 mg/kg (Rat)</td>
<td>&gt;2000 mg/kg (Rat)</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products: No information available
Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation: Irritating to eyes and skin
Sensitization: No information available
Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>75-09-2</td>
<td>Group 2A</td>
<td>Reasonably Anticipated</td>
<td>A3</td>
<td>X</td>
<td>A3</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>67-56-1</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>
Cyclohexene  110-83-8  Not listed  Not listed  Not listed  Not listed  Not listed  Not listed  
2-Methyl-2-butene  513-35-9  Not listed  Not listed  Not listed  Not listed  Not listed  Not listed  

IARC: (International Agency for Research on Cancer)  
Group 1 - Carcinogenic to Humans  
Group 2A - Probably Carcinogenic to Humans  
Group 2B - Possibly Carcinogenic to Humans  

NTP: (National Toxicity Program)  
Known - Known Carcinogen  
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen  

ACGIH: (American Conference of Governmental Industrial Hygienists)  
A1 - Known Human Carcinogen  
A2 - Suspected Human Carcinogen  
A3 - Animal Carcinogen  

Mexico - Occupational Exposure Limits - Carcinogens  
A1 - Confirmed Human Carcinogen  
A2 - Suspected Human Carcinogen  
A3 - Confirmed Animal Carcinogen  
A4 - Not Classifiable as a Human Carcinogen  
A5 - Not Suspected as a Human Carcinogen  

Mutagenic Effects  
Mutagenic effects have occured in microorganisms.  

Reproductive Effects  
Experiments have shown reproductive toxicity effects on laboratory animals.  

Developmental Effects  
Developmental effects have occurred in experimental animals.  

Teratogenicity  
No information available.  

STOT - single exposure  
Central nervous system (CNS)  Respiratory system  

STOT - repeated exposure  
Liver  Kidney  Blood  

Aspiration hazard  
No information available.  

Symptoms / effects, both acute and delayed  
Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting  

Endocrine Disruptor Information  
No information available.  

Other Adverse Effects  
Tumorigenic effects have been reported in experimental animals. See actual entry in RTECS for complete information.  

12. Ecological information  

Ecotoxicity  

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>EC50: &gt;=660 mg/L/96h</td>
<td>Pimephales promelas: LC50: 193 mg/L/96h</td>
<td>EC50: 1 mg/L/24 h</td>
<td>EC50: 140 mg/L/48h</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>Not listed</td>
<td>Pimephales promelas: LC50 &gt; 10000 mg/L 96h</td>
<td>EC50: 39000 mg/L 25 min</td>
<td>EC50 &gt; 10000 mg/L 24h</td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>Not listed</td>
<td>Poecilia reticulata: 7.1 mg/L/96h</td>
<td>Not listed</td>
<td>Daphnia: EC50: 5.3 mg/L/48h</td>
</tr>
<tr>
<td>2-Methyl-2-butene</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>EC50: = 3 mg/L, 48h (Daphnia magna)</td>
</tr>
</tbody>
</table>

Persistence and Degradability  
Persistence is unlikely based on information available.  

Bioaccumulation/ Accumulation  
No information available.  

Mobility  
Will likely be mobile in the environment due to its volatility.  

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>1.25</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>-0.74</td>
</tr>
</tbody>
</table>
13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

<table>
<thead>
<tr>
<th>Component</th>
<th>RCRA - U Series Wastes</th>
<th>RCRA - P Series Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride - 75-09-2</td>
<td>U080</td>
<td></td>
</tr>
<tr>
<td>Methyl alcohol - 67-56-1</td>
<td>U154</td>
<td></td>
</tr>
</tbody>
</table>

14. Transport information

DOT
UN-No: UN1593
Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
Packing Group: III

TDG
UN-No: UN1593
Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
Packing Group: III

IATA
UN-No: UN1593
Proper Shipping Name: Dichloromethane
Hazard Class: 6.1
Packing Group: III

IMDG/IMO
UN-No: UN1593
Proper Shipping Name: Dichloromethane
Hazard Class: 6.1
Packing Group: III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>200-838-9</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>200-659-6</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>203-807-8</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2-Methyl-2-butene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>208-156-3</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations
TSCA 12(b)

SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>75-09-2</td>
<td>&gt;99.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>67-56-1</td>
<td>0 - 0.4</td>
<td>1.0</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazard Categories

- Acute Health Hazard: Yes
- Chronic Health Hazard: Yes
- Fire Hazard: No
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: No

CWA (Clean Water Act)

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Clean Air Act

<table>
<thead>
<tr>
<th>Component</th>
<th>HAPS Data</th>
<th>Class 1 Ozone Depletors</th>
<th>Class 2 Ozone Depletors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

OSHA Occupational Safety and Health Administration

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifically Regulated Chemicals</th>
<th>Highly Hazardous Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>125 ppm STEL 12.5 ppm Action Level 25 ppm TWA</td>
<td>-</td>
</tr>
</tbody>
</table>

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>1000 lb 1 lb</td>
<td>-</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>5000 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

California Proposition 65

This product contains the following proposition 65 chemicals

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>California Prop. 65</th>
<th>Prop 65 NSRL</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>75-09-2</td>
<td>Carcinogen</td>
<td>200 µg/day 50 µg/day</td>
<td>Carcinogen</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>67-56-1</td>
<td>Developmental</td>
<td>-</td>
<td>Developmental</td>
</tr>
</tbody>
</table>

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylene chloride</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cyclohexene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2-Methyl-2-butene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

- Reportable Quantity (RQ): Y
- DOT Marine Pollutant: N
- DOT Severe Marine Pollutant: N
U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
D1B  Toxic materials
D2A  Very toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 27-Jan-2010
Revision Date 02-Oct-2015
Print Date 02-Oct-2015

Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

METHYL TERTIARY BUTYL ETHER

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely responsible for the accuracy and applicability of this information to a particular use or situation. Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification

Product Identification: METHYL TERTIARY BUTYL ETHER
Date of MSDS: 11/01/1990 Technical Review Date: 12/21/1995
FSC: 6810 NIIN: LIIN: 00N066437
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: GENIUM PUBLISHING CORP
Manufacturer's Address1: 1145 CATALYN ST
Manufacturer's Address2: SCHENECTADY, NY 12303-1836
Manufacturer's Country: US
General Information Telephone: 518-377-8854
Emergency Telephone: 518-377-8854
Emergency Telephone: 518-377-8854
MSDS Preparer's Name: MJ ALLISON
Proprietary: N
Reviewed: N
Published: Y
CAGE: 5Z768
Special Project Code: N

Contractor Information

Contractor's Name: GENIUM PUBLISHING CORPORATION
Contractor's Address1: 1145 CATALYN ST
Contractor's Address2: SCHENECTADY, NY 12303-1836
Contractor's Telephone: 518-377-8854
Contractor's CAGE: 5Z768

Section 2 - Composition/Information on Ingredients

METHYL TERTIARY BUTYL ETHER

Ingredient Name: EFTS OF OVEREXP:NOSE, THROAT, SKIN & CORNEA. ASPIR OF GASOLINE-MTBE MIX MAY CAUSE LUNG PNEUM. ACUTE:CONT W/EYES (ING 4)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

http://msds.ehs.cornell.edu/msds/msdsdod/a435/m217471.htm
8/3/2006
Ingredient Name: ETHER, TERT-BUTYL METHYL; (METHYL TERT-BUTYL ETHER) (SARA 313) (CERCLA)
Ingredient CAS Number: 1634-04-4 Ingredient CAS Code: M
RTECS Number: KN5250000 RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Ingredient Name: FIRST AID:MOUTH IF UNCON/CONVL. IF INGEST, CONSULT MD IMMED. DO NOT INDUCE VOMIT DUE TO ASPR PNEUM RISK. IF (ING 7)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:
Ingredient Name: HYGIENE PRACT: DRINKING, SMKG, USING TOILET/APPLYING COSMETICS. CONTAMD EQUIP: NEVER WEAR CONT LENSES IN WORK (ING 23)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 10: SUBSTANTIAL MTBE EXPOS. PFT'S, CHEST X-RAYS & SUPPORTIVE CARE MAY BE NEC AFTER ASPIR EXPOSURES.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 12: (EXPLO)/WATERWAYS. MTBE IS MORE WATER SOL/OTHER
GASOLINE COMPONENTS, SO THERE MAY BE HIGHER MBTE CONC IN (ING 14)

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 13:GROUNDWATER WHEN THERE IS SPILL OF GASOLINE-MTBE MIX. IT ALSO HAS MOD TO HIGH MOBILITY IN SOIL. MTBE IS (ING 15)

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 14:POORLY BIODEGRADED BY MICROORGANISMS IN ACTIVATED SLUDGE. CLEANUP OF GROUNDWATER CONTAM IS DFCLT. WHEN (ING 16)
Ingredient Name: ING 15:HIGH AIR-TO-WATER RATIOS ARE USED, AIR STRIPPING SYS CAN REMOVE MTBE. PROD OF ATM DEGRADATION INCL (ING 17)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 16:T-BUTYL FORMATE, ACETONE, & METHYL RADICALS. FOLLOW APPLIC OSHA REGS (29 CFR 1910.120).
Ingredient CAS Number: Ingredient CAS Code: X
Ingredient Name: ING 18: PRACTICE GOOD PERSONAL HYGIENE & HOUSEKEEPING PROCEDURES.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M

Ingredient Name: ING 22: AREA; SOFT LENSES MAY ABSORB, & ALL LENSES CONC, IRRITANTS. REMOVE THIS MATL FROM YOUR SHOES & EQUIP. (ING 24)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
Ingredient Name: ING 23: LAUNDER CONTAM CLOTHING BEFORE WEARING.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M

Ingredient Name: ING 3: OR SKIN MAY CAUSE IRRIT/BURNING @ HIGH CONC. INHAL MAY RSLT IN NAUS, VOMIT, SEDATION & GEN ATHESIA (CNS & (ING 5)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
Ingredient Name: ING 4: RESP DEPRESS). INGEST OF MTBE MAY RESULT IN ASPIRATION PNEUMONIA. CHRONIC: CHRONIC INHALATION CAUSES NASAL & TRACHEAL INFLAMMATION.

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M

Ingredient Name: ING 6: PERS IS COUGH/CHOKING, ASPIRATION MAY HAVE ALREADY OCCURRED; TRANSPORT TO EMERGENC MEDICAL FACILITY. AFTER FIRST AID, (ING 8)

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
Ingredient Name: ING 7: INGEST BECAUSE OF IT'S POOR ABSORBING QUALITIES. CAREFULLY OBSERVE FOR ANY DEVELOPMENT OF SYSTEMIC SIGNS. (ING 9)

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M

Ingredient Name: ING 8: IF LG QTYS OF MTBE INGESTED, SYRUP OF IPECAC IS PREFERENCES TO LAVAGE IN ALERT PATIENT REQ EMESIS. IF ASPIR HAS (ING 10)

Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
METHYL TERTIARY BUTYL ETHER

Ingredient Name: ING 9: OCCURRED, OBTAIN BASELINE CHEST X-RAY & VITAL SIGNS. LIVER FUNC STUDIES MAY BE INDICATED FOLLOWING (ING 11)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M

Ingredient Name: OTHER PREC: PROT PROGRAM THAT INCL REGULAR TRAINING, MAINTENANCE, INSPECTION, & EVAL. AVOID HEAT & IGNIT SOURCES. (ING 19)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 999999ZZ RTECS Code: M

<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: RESP PROT:SCBA. WARNING! NIOSH/MSHA APPRVD AIR-PURIFYING RESP DO NOT PROTECT WORKERS IN OXYG-DEFICIENT ATM.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SPILL PROC:FOR DISP. FOR LG SPILLS, DIKE FAR AHEAD OF SPILL TO CNTN. DO NOT ALLOW MTBE TO ENTER ENCLOSURED AREAS(ING 13)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPDAT:RADICALS. IF PRESENT IS SUFFICIENT CONC, THESE PROD OF PARTIAL OXIDATION CAN POSE SERIOUS HLTH HAZARD.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: VENT:PRODUCTIVITY LOC EXHST VENT IS PREF SINCE IT PVNT CONTAM DISPERSION INTO WORK AREA BY CONTROLLING IT @ ITS SOURCE.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code: 
% Low Volume: % Low Volume Code: 
% High Volume: % High Volume Code: 
% Text: N/K 
% Enviromental Weight: 
Other REC Limits: N/K 
OSHA PEL: NOT APPLICABLE  OSHA PEL Code: M 
OSHA STEL: OSHA STEL Code: 
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M 
ACGIH STEL: N/P ACGIH STEL Code: 
EPA Reporting Quantity: 
DOT Reporting Quantity: 
Ozone Depleting Chemical:  

Section 3 - Hazards Identification, Including Emergency Overview  
METHYL TERTIARY BUTYL ETHER  

Health Hazards Acute & Chronic: TARGET ORGANS: UPPER RESP TRACT, CNS. MTBE INGEST & INHAL TOX ARE BASED ON ANIMAL STUDIES. HUMAN EXPOS ARE REPORTED PRIMARILY W/EXPOS TO GASOLINE-MTBE MIX & W/USE OF MTBE IN DISSOLVING GALL BLADDER STO NES BY DIRECT INFUSION. RPTS REVEAL MTBE'S PRIMARY ANESTH EFT ON CNS. PROGRESSION OF NAUS, VOMIT & (EFTS OF OVEREXP)  

Signs & Symptoms of Overexposure:  
HLTH HAZ: SEDATION FOLLOWED BY GEN ANESTH IS NOTED W/INCRG EXPOS. WARM/BURNING SENSATION IS REPORTED W/GALL BLADDER INSTILLATION. ELEVATED LIVER FUNC STUDIES, DUODENAL INFLAMM, KIDNEY FAILURE, BLOOD CELL HEMOLYSIS, & FOUL BREATH ODOR ARE ALSO NOTED W/THIS PROC. ANIMAL STUDIES NOTE PRIMARY IRRIT TO MUC MEMB (ING 3)  

Medical Conditions Aggravated by Exposure:  
NONE REPORTED.  

LD50 LC50 Mixture:  LD50:(ORAL,RAT) 4 G/KG  

Route of Entry Indicators:  
Inhalation: YES  
Skin: YES  
Ingestion: YES  

Carcenogenicity Indicators  
NTP: NO  
IARC: NO  
OSHA: NO  

Carcinogenicity Explanation: NOT RELEVANT.  

Section 4 - First Aid Measures  
METHYL TERTIARY BUTYL ETHER
First Aid:
EYES: GENTLY LIFT LIDS & FLUSH IMMED & CONTINUOUSLY W/FLOODING AMTS OF WATER FOR @ LEAST 15 MIN UNTIL TRANSPORTED TO EMER MED FACILITY. CONSULT MD IMMED. SKIN: QUICKLY REMOVE CONTAM'D CLTHG. RINSE W/FLOODING AMTS OF WATER FOR @ LEAST 15 MIN. FOR RED/BLISTERED SKIN, CONSULT MD. WASH AFFECTED AREA W/SOAP & WATER. INHAL: REMOVE TO FRESH AIR & SUPPORT BRTHG AS NEEDED. INGEST: NEVER GIVE ANYTHING BY (ING 6)

Section 5 - Fire Fighting Measures
METHYL TERTIARY BUTYL ETHER

Fire Fighting Procedures:
NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N) (INCLG GOGG, RUB OVER-CLTHG, GLOVES & BOOTS). IF FEASIBLE, REMOVE CNTNRS FROM FIRE-RISK AREA. OTHERWISE (SUPDAT)

Unusual Fire or Explosion Hazard:
MTBE IS EXTREMELY FLAM. VAP MAY EXPLODE IF IGNIT IN ENCLSD AREA/TRAVEL TO SOURCE OF IGNIT & FLASH BACK. @ TEMP AT/ABOVE FL PT, MTBE CAN RELS VAPS THAT (SUPDAT)

Extinguishing Media:
USE DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY, OR ALCOHOL FOAM AS EXTINGUISHING MEDIA.

Flash Point: Flash Point Text: <18F, <-8C

Autoignition Temperature:

Autoignition Temperature Text: N/A

Lower Limit(s): 1.6%
Upper Limit(s): 8.4%

Section 6 - Accidental Release Measures
METHYL TERTIARY BUTYL ETHER

Spill Release Procedures:
NOTIFY SFTY PERS, EVAC ALL UNNEC PERS, REMOVE ALL HEAT & IGNIT SOURCES, & PROVIDE MAX EXPLO-PROOF VENT. CLEANUP PERS SHOULD PROTECT AGAINST VAP INHAL & SKIN/EYE CONT. TAKE UP SPILLED MATL W/NONCOMBUST ABSORB MATL & PLACE IN APPROP CNTNRS (ING 12)

Section 7 - Handling and Storage
METHYL TERTIARY BUTYL ETHER

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
METHYL TERTIARY BUTYL ETHER

Respiratory Protection:
SEEK PROFESSIONAL ADVICE PRIOR TO RESP SELECTION & USE. FOLLOW OSHA RESP
REGS (29 CFR 1910.134) & IF NEC, WEAR NIOSH/MSHA APPRVD RESP. FOR EMER/NONROUTINE OPERATIONS (CLEANING SPILLS, REACTOR VESSELS /STORAGE TANKS), WEAR NIOSH/MSHA (ING 20)

Ventilation:
PROVIDE GEN & LOC EXPLO-PROOF VENT SYS TO MAINTAIN AIRBORNE CONC @ LEV THAT PROMOTE WORKER SFTY & (ING 21)

Protective Gloves:
IMPERVIOUS GLOVES.

Eye Protection:
ANSI APPRVD CHEM WORKERS GOGG & FSHLD.

Other Protective Equipment:
IMPERVIOUS BOOTS, APRONS, & GAUNTLETS. ANSI APPRVD EMER EYE WASH & DELUGE SHOWER (FP N).

Work Hygienic Practices:
NEVER EAT, DRINK/SMOKE IN WORK AREAS. PRACTICE GOOD PERSONAL HYGIENE AFTER USING MATL, ESPECIALLY BEFORE EATING,(ING 22)

Supplemental Health & Safety Information:
APPEAR/ODOR: MINT OR TERPENE-LIKE ODOR. FIRE FIGHT PROC: USE WATER SPRAY TO COOL FIRE-EXPOS CNTNRS. BE AWARE OF RUNOFF FROM FIRE CTL METH. DO NOT RELS TO ENCLSD AREAS, SEWERS/WATERWAYS DUE TO POTNTL EXP LO & HLTH HAZ MTBE PRESENT. EXPLO HAZ: FORM FLAM MIXS. CNDTNS TO AVOID: IN ACID SOLNS. HAZ DECOMP:& METHYL (ING 2)

### Section 9 - Physical & Chemical Properties

#### METHYL TERTIARY BUTYL ETHER

**HCC:**

**NRC/State License Number:**

**Net Property Weight for Ammo:**

**Boiling Point:** Boiling Point Text: 131°F, 55°C

**Melting/Freezing Point:** Melting/Freezing Text: <166°F, <74°C

**Decomposition Point:** Decomposition Text: N/K

**Vapor Pressure:** 245 @ 77°F

**Vapor Density:** N/K

**Percent Volatile Organic Content:**

**Specific Gravity:** 0.7405(20°C/4°C)

**Volatile Organic Content Pounds per Gallon:** N/K

**pH:** N/K

**Volatile Organic Content Grams per Liter:** N/K

**Viscosity:** N/P

**Evaporation Weight and Reference:** NOT KNOWN

**Solubility in Water:** 4.8G/100G

**Appearance and Odor:** A CLEAR, COLORLESS LIQUID WITH A SLIGHT HYDROCARBON ODOR WITH A MILD (SUPDAT)

**Percent Volatiles by Volume:** N/K

**Corrosion Rate:** N/K

### Section 10 - Stability & Reactivity Data

#### METHYL TERTIARY BUTYL ETHER

**Stability Indicator:** YES

**Materials to Avoid:** INCOMPAT & UNSTABLE W/STRONG OXIDIZING AGENTS, STRONG ACIDS, CAUSTICS, AMINES, ALDEHYDES, AMMONIA, & CHLORINATED CMPDS.

**Stability Condition to Avoid:**

http://msds.ehs.cornell.edu/msds/msdsdod/a435/m217471.htm

8/3/2006
HEAT & IGNIT SOURCES. MTBE IS STABLE @ ROOM TEMP IN CLSD CNTNRS UNDER NORM STOR & HNDLG CNDTNS. MTBE IS UNSTABLE(SUPDAT)

Hazardous Decomposition Products:
THERM OXIDATIVE DECOMP CAN PRDCE: CO*2 & H*2O VAP; INCOMPLETE COMBUST:CO, T-BUTYL FORMATE, ACETONE, FORMIC ACID (SUPDAT)

Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization: NOT RELEVANT.

Section 11 - Toxicological Information
METHYL TERTIARY BUTYL ETHER

Toxicological Information:
N/P

Section 12 - Ecological Information
METHYL TERTIARY BUTYL ETHER

Ecological Information:
N/P

Section 13 - Disposal Considerations
METHYL TERTIARY BUTYL ETHER

Waste Disposal Methods:
CONTACT YOUR SUPPLIER/LICENSED CONTRACTOR FOR DETAILED RECOMMENDATIONS. FOLLOW APPLIC FEDERAL, STATE, AND LOCAL REGS.

Section 14 - MSDS Transport Information
METHYL TERTIARY BUTYL ETHER

Transport Information:
N/P

Section 15 - Regulatory Information
METHYL TERTIARY BUTYL ETHER

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
METHYL TERTIARY BUTYL ETHER

Other Information:
N/P

HAZCOM Label Information

Product Identification: METHYL TERTIARY BUTYL ETHER
CAGE: 5Z768
Assigned Individual: N
Company Name: GENIUM PUBLISHING CORPORATION
Company PO Box:
Company Street Address1: 1145 CATALYN ST
Company Street Address2: SCHENECTADY, NY 12303-1836 US
Health Emergency Telephone: 518-377-8854
Label Required Indicator: Y
Date Label Reviewed: 12/21/1995
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/21/1995
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Severe
Contact Hazard: Severe
Fire Hazard: Severe
Reactivity Hazard: Slight

8/9/2002 9:24:08 AM
SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Identification of the substance: m-Xylene
Article number: 3791
Registration number (REACH): It is not required to list the identified uses because the substance is not subject to registration according to REACH (< 1 t/a)

Index No: 601-022-00-9
EC number: 203-576-3
CAS number: 108-38-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: laboratory chemical, laboratory and analytical use

1.3 Details of the supplier of the safety data sheet

Carl Roth GmbH + Co KG
Schoemperlenstr. 3-5
D-76185 Karlsruhe
Germany

Telephone: +49 (0) 721 - 56 06 0
Telefax: +49 (0) 721 - 56 06 149
e-mail: sicherheit@carlroth.de
Website: www.carlroth.de

Competent person responsible for the safety data sheet: Department Health, Safety and Environment

e-mail (competent person): sicherheit@carlroth.de

1.4 Emergency telephone number

Emergency information service: Poison Centre Munich: +49/(0)89 19240

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

<table>
<thead>
<tr>
<th>Section</th>
<th>Hazard class</th>
<th>Hazard class and category</th>
<th>Hazard statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>flammable liquid</td>
<td>(Flam. Liq. 3)</td>
<td>H226</td>
</tr>
<tr>
<td>3.1D</td>
<td>acute toxicity (dermal)</td>
<td>(Acute Tox. 4)</td>
<td>H312</td>
</tr>
<tr>
<td>3.1I</td>
<td>acute toxicity (inhal.)</td>
<td>(Acute Tox. 4)</td>
<td>H332</td>
</tr>
<tr>
<td>3.2</td>
<td>skin corrosion/irritation</td>
<td>(Skin Irrit. 2)</td>
<td>H315</td>
</tr>
</tbody>
</table>
Classification acc. to GHS

<table>
<thead>
<tr>
<th>Section</th>
<th>Hazard class</th>
<th>Hazard class and category</th>
<th>Hazard statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>serious eye damage/eye irritation</td>
<td>(Eye Irrit. 2)</td>
<td>H319</td>
</tr>
<tr>
<td>3.8R</td>
<td>specific target organ toxicity - single exposure (respiratory tract irritation)</td>
<td>(STOT SE 3)</td>
<td>H335</td>
</tr>
<tr>
<td>3.9</td>
<td>specific target organ toxicity - repeated exposure</td>
<td>(STOT RE 2)</td>
<td>H373</td>
</tr>
<tr>
<td>3.10</td>
<td>aspiration hazard</td>
<td>(Asp. Tox. 1)</td>
<td>H304</td>
</tr>
</tbody>
</table>

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

Signal word: Danger

Pictograms

GHS02, GHS07, GHS08

Hazard statements

H226 Flammable liquid and vapour
H304 May be fatal if swallowed and enters airways
H312+H332 Harmful in contact with skin or if inhaled
H315 Causes skin irritation
H319 Causes serious eye irritation
H335 May cause respiratory irritation
H373 May cause damage to organs (respiratory system, nervous system) through prolonged or repeated exposure

Precautionary statements

Precautionary statements - prevention

P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260 Do not breathe mist/vapours/spray.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statements - response

P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor/...  
P302+P352 IF ON SKIN: Wash with plenty of soap and water.  
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P331 Do NOT induce vomiting.

Labelling of packages where the contents do not exceed 125 ml

Signal word: Danger

Symbol(s)
Safety data sheet
according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

m-Xylene ≥ 99%, for synthesis

article number: 3791

H304 May be fatal if swallowed and enters airways.
P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P331 Do NOT induce vomiting.

2.3 Other hazards
There is no additional information.

SECTION 3: Composition/information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Name of substance</th>
<th>1,3-Dimethylbenzene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index No</td>
<td>601-022-00-9</td>
</tr>
<tr>
<td>EC number</td>
<td>203-576-3</td>
</tr>
<tr>
<td>CAS number</td>
<td>108-38-3</td>
</tr>
<tr>
<td>Molecular formula</td>
<td>C₈H₁₀</td>
</tr>
<tr>
<td>Molar mass</td>
<td>106.2 g/mol</td>
</tr>
</tbody>
</table>

SECTION 4: First aid measures

4.1 Description of first aid measures

General notes
Take off contaminated clothing.

Following inhalation
Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact
Rinse skin with water/shower. In case of skin irritation, consult a physician.

Following eye contact
Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart. In case of eye irritation consult an ophthalmologist.

Following ingestion
Rinse mouth. Do not induce vomiting. Aspiration hazard. Call a physician immediately.

4.2 Most important symptoms and effects, both acute and delayed
Irritation, Cough, Headache, Impairment of vision, Dizziness, Vertigo, Nausea, Vomiting, Diarrhoea, Breathing difficulties, Unconsciousness, Aspiration hazard

4.3 Indication of any immediate medical attention and special treatment needed
none
SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Co-ordinate fire-fighting measures to the fire surroundings
water spray, foam, dry extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing media
water jet

5.2 Special hazards arising from the substance or mixture
Combustible. Vapours are heavier than air, spread along floors and form explosive mixtures with air.

Hazardous combustion products
In case of fire may be liberated: carbon monoxide (CO), carbon dioxide (CO2)

5.3 Advice for firefighters
Vapours are heavier than air. Beware of reignition. Fight fire with normal precautions from a reasonable distance. Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel
Use personal protective equipment as required. Avoid contact with skin, eyes and clothes. Do not breathe vapour/spray. Avoidance of ignition sources.

6.2 Environmental precautions
Keep away from drains, surface and ground water. Explosive properties.

6.3 Methods and material for containment and cleaning up
Advises on how to contain a spill
Covering of drains.

Advises on how to clean up a spill
Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases
Place in appropriate containers for disposal. Ventilate affected area.

6.4 Reference to other sections
SECTION 7: Handling and storage

7.1 Precautions for safe handling
Provide adequate ventilation as well as local exhaustion at critical locations. Avoid exposure. When not in use, keep containers tightly closed.

- Measures to prevent fire as well as aerosol and dust generation

Keep away from sources of ignition - No smoking.

Take precautionary measures against static discharge.

Advice on general occupational hygiene
Wash hands before breaks and after work. Keep away from food, drink and animal feedingstuffs. When using do not smoke.

7.2 Conditions for safe storage, including any incompatibilities
Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight.

Incompatible substances or mixtures
Observe hints for combined storage.

Consideration of other advice
Ground/bond container and receiving equipment.

- Ventilation requirements
Use local and general ventilation.

- Specific designs for storage rooms or vessels
Recommended storage temperature: 15 – 25 °C.

7.3 Specific end use(s)
No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of agent</th>
<th>CAS No</th>
<th>Identifier</th>
<th>TWA [ppm]</th>
<th>TWA [mg/m³]</th>
<th>STEL [ppm]</th>
<th>STEL [mg/m³]</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>m-xylene</td>
<td>108-38-3</td>
<td>IOELV</td>
<td>50</td>
<td>221</td>
<td>100</td>
<td>442</td>
<td>2000/39/EC</td>
</tr>
<tr>
<td>GB</td>
<td>m-xylene</td>
<td>108-38-3</td>
<td>WEL</td>
<td>50</td>
<td>220</td>
<td>100</td>
<td>441</td>
<td>EH40/2005</td>
</tr>
</tbody>
</table>

Notation

STEL  Short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15-minute period (unless otherwise specified)
TWA  Time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8 hours time-weighted average (unless otherwise specified)
Biological limit values

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of agent</th>
<th>Parameter</th>
<th>Identifier</th>
<th>Value</th>
<th>Material</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB</td>
<td>m-xylene</td>
<td>methylhippuric acids</td>
<td>BMGV</td>
<td>650 mmol/mol</td>
<td>urine</td>
<td>EH40/2005</td>
</tr>
</tbody>
</table>

Relevant DNELs/DMELs/PNECs and other threshold levels

- **human health values**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Threshold level</th>
<th>Protection goal, route of exposure</th>
<th>Used in</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNEL</td>
<td>221 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>chronic - systemic effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>442 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>acute - systemic effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>221 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>chronic - local effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>442 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>acute - local effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>212 mg/kg bw/day</td>
<td>human, dermal</td>
<td>worker (industry)</td>
<td>chronic - systemic effects</td>
</tr>
</tbody>
</table>

- **environmental values**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Threshold level</th>
<th>Environmental compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNEC</td>
<td>0,25 mg/l</td>
<td>water</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,044 mg/l</td>
<td>freshwater</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,004 mg/l</td>
<td>marine water</td>
</tr>
<tr>
<td>PNEC</td>
<td>1,6 mg/l</td>
<td>sewage treatment plant (STP)</td>
</tr>
<tr>
<td>PNEC</td>
<td>2,52 mg/kg</td>
<td>freshwater sediment</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,252 mg/kg</td>
<td>marine sediment</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,852 mg/kg</td>
<td>soil</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Individual protection measures (personal protective equipment)

**Eye/face protection**

Use safety goggle with side protection.

**Skin protection**

- **hand protection**

Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.
• **type of material**
  FKM (fluoro rubber)

• **material thickness**
  0.4 mm.

• **breakthrough times of the glove material**
  >480 minutes (permeation: level 6)

• **other protection measures**
  Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

**Respiratory protection**

Respiratory protection necessary at: Aerosol or mist formation. Type: A (against organic gases and vapours with a boiling point of > 65 °C, colour code: Brown).

**Environmental exposure controls**

Keep away from drains, surface and ground water.

---

**SECTION 9: Physical and chemical properties**

**9.1 Information on basic physical and chemical properties**

**Appearance**

- **Physical state**: liquid (fluid)
- **Colour**: colourless
- **Odour**: characteristic
- **Odour threshold**: No data available

**Other physical and chemical parameters**

- **pH (value)**: This information is not available.
- **Melting point/freezing point**: -47.8 °C at 1.013 hPa
- **Initial boiling point and boiling range**: 139.1 °C at 1.013 hPa
- **Flash point**: 27 °C at 1.013 hPa
- **Evaporation rate**: no data available
- **Flammability (solid, gas)**: not relevant (fluid)

**Explosive limits**

- **Lower explosion limit (LEL)**: 1.1 vol%
- **Upper explosion limit (UEL)**: 7 vol%

**Explosion limits of dust clouds**

not relevant

**Vapour pressure**: 8 hPa at 20 °C

**Density**: 0.86 g/cm³ at 25 °C

**Vapour density**: 3.66 (air = 1)
m-Xylene ≥ 99%, for synthesis
article number: 3791

Bulk density
Not applicable

Relative density
Information on this property is not available.

Solubility(ies)

Water solubility
~ 146 mg/l at 25 °C

Partition coefficient
n-octanol/water (log KOW) 3,2 (pH value: 7, 20 °C) (ECHA)
Soil organic carbon/water (log KOC) 2,73 (ECHA)

Auto-ignition temperature
528 °C at 1.013 hPa - ECHA

Decomposition temperature
no data available

Viscosity
- kinematic viscosity 0,6756 mm²/s
- dynamic viscosity 0,581 mPa s at 25 °C

Explosive properties
Shall not be classified as explosive

Oxidising properties
none

9.2 Other information
Surface tension 28,01 mN/m (25 °C)

Temperature class (EU, acc. to ATEX) T1 (Maximum permissible surface temperature on the equipment: 450°C)

SECTION 10: Stability and reactivity

10.1 Reactivity
Risk of ignition. In case of warming: Vapours can form explosive mixtures with air.

10.2 Chemical stability
The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions
Violent reaction with: Oxidisers, Nitric acid, Sulphuric acid, Sulphur, Acids

10.4 Conditions to avoid
Keep away from heat.

10.5 Incompatible materials
plastic and rubber

10.6 Hazardous decomposition products
Hazardous combustion products: see section 5.
m-Xylene ≥ 99%, for synthesis

article number: 3791

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

<table>
<thead>
<tr>
<th>Exposure route</th>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>oral</td>
<td>LD50</td>
<td>3.523 mg/kg</td>
<td>rat</td>
<td>ECHA</td>
</tr>
</tbody>
</table>

Skin corrosion/irritation
Causes skin irritation.

Serious eye damage/eye irritation
Causes serious eye irritation.

Respiratory or skin sensitisation
Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties
Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant

- Specific target organ toxicity - single exposure
  May cause respiratory irritation.

- Specific target organ toxicity - repeated exposure
  May cause damage to organs (respiratory system, nervous system) through prolonged or repeated exposure.

Aspiration hazard
May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

- If swallowed
diarrhoea, vomiting, aspiration hazard

- If in eyes
Causes serious eye irritation

- If inhaled
irritant effects, cough, breathing difficulties, pulmonary oedema

- If on skin
causes skin irritation, risk of absorption via the skin

Other information
Other adverse effects: Headache, Impairment of vision, Dizziness, Vertigo, Nausea, Dyspnoea, Unconsciousness, Liver and kidney damage, Symptoms can occur only after several hours
SECTION 12: Ecological information

12.1 Toxicity

acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.

**Aquatic toxicity (acute)**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50</td>
<td>2,6 mg/l</td>
<td>rainbow trout</td>
<td>ECHA</td>
<td>96 h</td>
</tr>
<tr>
<td>ErC50</td>
<td>4,7 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>72 h</td>
</tr>
</tbody>
</table>

**Aquatic toxicity (chronic)**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC50</td>
<td>2,2 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>73 h</td>
</tr>
<tr>
<td>NOEC</td>
<td>0,714 mg/l</td>
<td>striped brill</td>
<td>ECHA</td>
<td>35 d</td>
</tr>
<tr>
<td>NOEC</td>
<td>1,57 mg/l</td>
<td>aquatic invertebrates</td>
<td>ECHA</td>
<td>21 d</td>
</tr>
<tr>
<td>NOEC</td>
<td>0,44 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>73 h</td>
</tr>
</tbody>
</table>

12.2 Process of degradability

The substance is readily biodegradable.

Theoretical Oxygen Demand: 3,165 mg/mg

Theoretical Carbon Dioxide: 3,316 mg/mg

<table>
<thead>
<tr>
<th>Process</th>
<th>Degradation rate</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>oxygen depletion</td>
<td>90 %</td>
<td>28 d</td>
</tr>
</tbody>
</table>

12.3 Bioaccumulative potential

Does not significantly accumulate in organisms.

n-octanol/water (log KOW) 3,2 (pH value: 7, 20 °C)

BCF >5,5 – <12,2

12.4 Mobility in soil

Henry's law constant 623 Pa m³/mol at 25 °C

The Organic Carbon normalised adsorption coefficient 2,73

12.5 Results of PBT and vPvB assessment

Data are not available.

12.6 Other adverse effects

Data are not available.
SECTION 13: Disposal considerations

13.1 Waste treatment methods

This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations.

Sewage disposal-relevant information
Do not empty into drains.

Waste treatment of containers/packagings
It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

Sewage disposal-relevant information
Do not empty into drains.

Waste treatment of containers/packagings
It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste

The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks

Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.

SECTION 14: Transport information

14.1 UN number

1307

14.2 UN proper shipping name

XYLENES

Hazardous ingredients

m-Xylene

14.3 Transport hazard class(es)

Class 3 (flammable liquids)

14.4 Packing group

III (substance presenting low danger)

14.5 Environmental hazards

none (non-environmentally hazardous acc. to the dangerous goods regulations)

14.6 Special precautions for user

Provisions for dangerous goods (ADR) should be complied within the premises.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

The cargo is not intended to be carried in bulk.

14.8 Information for each of the UN Model Regulations

• Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN)

UN number 1307
Proper shipping name: XYLENES

Particulars in the transport document: UN1307, XYLENES, 3, III, (D/E)

Class: 3

Classification code: F1

Packing group: III

Danger label(s): 3

Excepted quantities (EQ): E1

Limited quantities (LQ): 5 L

Transport category (TC): 3

Tunnel restriction code (TRC): D/E

Hazard identification No: 30

Emergency Action Code: 3YE

* International Maritime Dangerous Goods Code (IMDG)

UN number: 1307

Proper shipping name: XYLENES

Particulars in the shipper's declaration: UN1307, XYLENES, 3, III, 27°C c.c.

Class: 3

Marine pollutant: -

Packing group: III

Danger label(s): 3

Special provisions (SP): 223

Excepted quantities (EQ): E1

Limited quantities (LQ): 5 L

EmS: F-E, S-D

Stowage category: A

* International Civil Aviation Organization (ICAO-IATA/DGR)

UN number: 1307

Proper shipping name: Xylene

Particulars in the shipper's declaration: UN1307, Xylene, 3, III

Class: 3

Packing group: III

Safety data sheet according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

m-Xylene ≥ 99%, for synthesis

article number: 3791

United Kingdom (en)
15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Relevant provisions of the European Union (EU)

- Regulation 649/2012/EU concerning the export and import of hazardous chemicals (PIC)
  Not listed.

- Regulation 1005/2009/EC on substances that deplete the ozone layer (ODS)
  Not listed.

- Regulation 850/2004/EC on persistent organic pollutants (POP)
  Not listed.

- Restrictions according to REACH, Annex XVII

<table>
<thead>
<tr>
<th>Name of substance</th>
<th>CAS No</th>
<th>Wt%</th>
<th>Type of registration</th>
<th>Conditions of restriction</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-Xylene</td>
<td>100</td>
<td>100</td>
<td>1907/2006/EC annex XVII</td>
<td>R3</td>
<td>3</td>
</tr>
<tr>
<td>m-Xylene</td>
<td>100</td>
<td>100</td>
<td>1907/2006/EC annex XVII</td>
<td>R40</td>
<td>40</td>
</tr>
</tbody>
</table>

Legend

R3

1. Shall not be used in:
   - ornamental articles intended to produce light or colour effects by means of different phases, for example in ornamental lamps and ashtrays,
   - tricks and jokes,
   - games for one or more participants, or any article intended to be used as such, even with ornamental aspects,
2. Articles not complying with paragraph 1 shall not be placed on the market.
3. Shall not be placed on the market if they contain a colouring agent, unless required for fiscal reasons, or perfume, or both, if they:
   - can be used as fuel in decorative oil lamps for supply to the general public, and,
   - present an aspiration hazard and are labelled with R65 or H304,
4. Decorative oil lamps for supply to the general public shall not be placed on the market unless they conform to the European Standard on Decorative oil lamps (EN 14059) adopted by the European Committee for Standardisation (CEN).
5. Without prejudice to the implementation of other Community provisions relating to the classification, packaging and labelling of dangerous substances and mixtures, suppliers shall ensure, before the placing on the market, that the following requirements are met:
   (a) lamp oils, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked as follows: 'Keep lamps filled with this liquid out of the reach of children'; and, by 1 December 2010, 'Just a sip of lamp oil - or even sucking the wick of lamps - may lead to life threatening lung damage';
   (b) grill lighter fluids, labelled with R65 or H304, intended for supply to the general public are legibly and indelibly marked by 1 December 2010 as follows: 'Just a sip of grill lighter may lead to life threatening lung damage';
   (c) lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are packaged in black opaque containers not exceeding 1 litre by 1 December 2010.
6. No later than 1 June 2014, the Commission shall request the European Chemicals Agency to prepare a dossier, in accordance with Article 69 of the present Regulation with a view to ban, if appropriate, grill lighter fluids and fuel for decorative lamps, labelled R65 or H304, intended for supply to the general public.
7. Natural or legal persons placing on the market for the first time lamp oils and grill lighter fluids, labelled with R65 or H304, shall by 1 December 2011, and annually thereafter, provide data on alternatives to lamp oils and grill lighter fluids labelled R65 or H304 to the competent authority in the Member State concerned. Member States shall make those data available to the Commission.
m-Xylene ≥ 99%, for synthesis

article number: 3791

Legend
R40 1. Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are intended for supply to the general public for entertainment and decorative purposes such as the following:
- metallic glitter intended mainly for decoration,
- artificial snow and frost,
- ‘whoopee’ cushions,
- silly string aerosols,
- imitation excrement,
- horns for parties,
- decorative flakes and foams,
- artificial cobwebs,
- stink bombs.
2. Without prejudice to the application of other Community provisions on the classification, packaging and labelling of substances, suppliers shall ensure before the placing on the market that the packaging of aerosol dispensers referred to above is marked visibly, legibly and indelibly with:
'For professional users only'.
3. By way of derogation, paragraphs 1 and 2 shall not apply to the aerosol dispensers referred to Article 8 (1a) of Council Directive 75/324/EEC (2).
4. The aerosol dispensers referred to in paragraphs 1 and 2 shall not be placed on the market unless they conform to the requirements indicated.

• Restrictions according to REACH, Title VIII
None.

• List of substances subject to authorisation (REACH, Annex XIV)/SVHC - candidate list
not listed

• Seveso Directive

<table>
<thead>
<tr>
<th>2012/18/EU (Seveso III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>P5c</td>
</tr>
</tbody>
</table>

Notation
51) Flammable liquids, categories 2 or 3 not covered by P5a and P5b

• Directive 75/324/EEC relating to aerosol dispensers

Filling batch

VOC content 100 %
860 g/l

Directive on industrial emissions (VOCs, 2010/75/EU)

VOC content 100 %

VOC content 860 g/l

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) - Annex II
not listed

Regulation 166/2006/EC concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)
not listed

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD)
not listed
Safety data sheet
according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

m-Xylene ≥ 99%, for synthesis
article number: 3791

Regulation 98/2013/EU on the marketing and use of explosives precursors
not listed

Regulation 111/2005/EC laying down rules for the monitoring of trade between the Community and third countries in drug precursors
not listed

National inventories
Substance is listed in the following national inventories:

<table>
<thead>
<tr>
<th>Country</th>
<th>National inventories</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>AICS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>CA</td>
<td>DSL</td>
<td>substance is listed</td>
</tr>
<tr>
<td>CN</td>
<td>IECSC</td>
<td>substance is listed</td>
</tr>
<tr>
<td>EU</td>
<td>ECSI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>EU</td>
<td>REACH Reg.</td>
<td>substance is listed</td>
</tr>
<tr>
<td>JP</td>
<td>CSCL-ENCS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>JP</td>
<td>ISHA-ENCS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>KR</td>
<td>KECI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>MX</td>
<td>INSQ</td>
<td>substance is listed</td>
</tr>
<tr>
<td>NZ</td>
<td>NZIoC</td>
<td>substance is listed</td>
</tr>
<tr>
<td>PH</td>
<td>PICCS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>TW</td>
<td>TCSI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>US</td>
<td>TSCA</td>
<td>substance is listed</td>
</tr>
</tbody>
</table>

Legend
AICS          Australian Inventory of Chemical Substances
CSCL-ENCS     List of Existing and New Chemical Substances (CSCL-ENCS)
DSL           Domestic Substances List (DSL)
ECSI          EC Substance Inventory (EINECS, ELINCS, NLP)
IECSC         Inventory of Existing Chemical Substances Produced or Imported in China
INSQ          National Inventory of Chemical Substances
ISHA-ENCS     Inventory of Existing and New Chemical Substances (ISHA-ENCS)
KECI          Korea Existing Chemicals Inventory
NZIoC         New Zealand Inventory of Chemicals
PICCS         Philippine Inventory of Chemicals and Chemical Substances
REACH Reg.    REACH registered substances
TCSI          Taiwan Chemical Substance Inventory
TSCA          Toxic Substance Control Act

15.2 Chemical Safety Assessment
No Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

Abbreviations and acronyms
<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Descriptions of used abbreviations</th>
</tr>
</thead>
</table>
| 2000/39/EC | Comission Directive establishing a first list of indicative occupational exposure limit values in implementa-
| ADN    | Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways) |
| ADR    | Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road) |
| BCF    | bioconcentration factor |
| CAS    | Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances) |
| CLP    | Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures |
| CMR    | Carcinogenic, Mutagenic or toxic for Reproduction |
| DGR    | Dangerous Goods Regulations (see IATA/DGR) |
| DMEL   | Derived Minimal Effect Level |
| DNEL   | Derived No-Effect Level |
| EINECS | European Inventory of Existing Commercial Chemical Substances |
| ELINCS | European List of Notified Chemical Substances |
| EmS    | Emergency Schedule |
| GHS    | "Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations |
| IATA   | International Air Transport Association |
| IATA/DGR | Dangerous Goods Regulations (DGR) for the air transport (IATA) |
| ICAO   | International Civil Aviation Organization |
| IMDG   | International Maritime Dangerous Goods Code |
| Index No | the Index number is the identification code given to the substance in Part 3 of Annex VI to Regulation (EC) No 1272/2008 |
| IOELV  | indicative occupational exposure limit value |
| MARPOL | International Convention for the Prevention of Pollution from Ships (abbr. of "Marine Pollutant") |
| NLP    | No-Longer Polymer |
| PBT    | Persistent, Bioaccumulative and Toxic |
| PNEC   | Predicted No-Effect Concentration |
| ppm    | parts per million |
| REACH  | Registration, Evaluation, Authorisation and Restriction of Chemicals |
| RID    | Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail) |
| STEL   | short-term exposure limit |
| SVHC   | Substance of Very High Concern |
| TWA    | time-weighted average |
| VOC    | Volatile Organic Compounds |
| vPvB   | very Persistent and very Bioaccumulative |
| WEL    | workplace exposure limit |
m-Xylene ≥ 99%, for synthesis
article number: 3791

Key literature references and sources for data
- Regulation (EC) No. 1272/2008 (CLP, EU GHS)
- Dangerous Goods Regulations (DGR) for the air transport (IATA)
- International Maritime Dangerous Goods Code (IMDG)

List of relevant phrases (code and full text as stated in chapter 2 and 3)

<table>
<thead>
<tr>
<th>Code</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>H226</td>
<td>flammable liquid and vapour</td>
</tr>
<tr>
<td>H304</td>
<td>may be fatal if swallowed and enters airways</td>
</tr>
<tr>
<td>H312</td>
<td>harmful in contact with skin</td>
</tr>
<tr>
<td>H315</td>
<td>causes skin irritation</td>
</tr>
<tr>
<td>H319</td>
<td>causes serious eye irritation</td>
</tr>
<tr>
<td>H332</td>
<td>harmful if inhaled</td>
</tr>
<tr>
<td>H335</td>
<td>may cause respiratory irritation</td>
</tr>
<tr>
<td>H373</td>
<td>may cause damage to organs (respiratory system, nervous system) through prolonged or repeated exposure</td>
</tr>
</tbody>
</table>

Disclaimer
The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.
Material Safety Data Sheet
Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene
Catalog Codes: SLN1789, SLN2401
CAS#: 91-20-3
RTECS: QJ0525000
TSCA: TSCA 8(b) inventory: Naphthalene
CI#: Not available.
Synonym: Chemical Name: Not available.
Chemical Formula: C10H8

Contact Information:
Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396
US Sales: 1-800-901-7247
International Sales: 1-281-441-4400
Order Online: ScienceLab.com
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures
Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation:
Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 567°C (1052.6°F)

**Flash Points:**
- CLOSED CUP: 88°C (190.4°F).
- OPEN CUP: 79°C (174.2°F).

**Flammable Limits:**
- LOWER: 0.9%
- UPPER: 5.9%

**Products of Combustion:** These products are carbon oxides (CO, CO₂).

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

### Section 6: Accidental Release Measures

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:** Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
Section 7: Handling and Storage

Precautions:
Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Israel: TWA: 10 (ppm) TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995] TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995]
Australia: STEL: 15 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.
**Ionicity (in Water):** Not available.

**Dispersion Properties:**
Partially dispersed in hot water, methanol, n-octanol. Very slightly dispersed in cold water. See solubility in methanol, n-octanol.

**Solubility:**
Partially soluble in methanol, n-octanol. Very slightly soluble in cold water, hot water.

### Section 10: Stability and Reactivity Data

<table>
<thead>
<tr>
<th><strong>Stability:</strong></th>
<th>The product is stable.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instability Temperature:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Conditions of Instability:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Incompatibility with various substances:</strong></td>
<td>Highly reactive with oxidizing agents.</td>
</tr>
<tr>
<td><strong>Corrosivity:</strong></td>
<td>Non-corrosive in presence of glass.</td>
</tr>
<tr>
<td><strong>Special Remarks on Reactivity:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Special Remarks on Corrosivity:</strong></td>
<td>May attack some forms of rubber and plastic</td>
</tr>
<tr>
<td><strong>Polymerization:</strong></td>
<td>No.</td>
</tr>
</tbody>
</table>

### Section 11: Toxicological Information

<table>
<thead>
<tr>
<th><strong>Routes of Entry:</strong></th>
<th>Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxicity to Animals:</strong></td>
<td></td>
</tr>
<tr>
<td>WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 490 mg/kg [Rat]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].</td>
<td></td>
</tr>
<tr>
<td><strong>Chronic Effects on Humans:</strong></td>
<td></td>
</tr>
<tr>
<td>CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).</td>
<td></td>
</tr>
<tr>
<td><strong>Other Toxic Effects on Humans:</strong></td>
<td></td>
</tr>
<tr>
<td>Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).</td>
<td></td>
</tr>
<tr>
<td><strong>Special Remarks on Toxicity to Animals:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Special Remarks on Chronic Effects on Humans:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Special Remarks on other Toxic Effects on Humans:</strong></td>
<td>Not available.</td>
</tr>
</tbody>
</table>

### Section 12: Ecological Information

<table>
<thead>
<tr>
<th><strong>Ecotoxicity:</strong></th>
<th>Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOD5 and COD:</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Products of Biodegradation:</strong></td>
<td></td>
</tr>
<tr>
<td>Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.</td>
<td></td>
</tr>
<tr>
<td><strong>Toxicity of the Products of Biodegradation:</strong></td>
<td>The products of degradation are more toxic.</td>
</tr>
</tbody>
</table>
Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.
Identification: : Naphthalene, refined : UN1334 PG: III
Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Naphthalene Pennsylvania RTK: Naphthalene Florida: Naphthalene Minnesota: Naphthalene Massachusetts RTK: Naphthalene TSCA 8(b) inventory: Naphthalene TSCA 8(a) PAIR: Naphthalene TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87 SARA 313 toxic chemical notification and release reporting: Naphthalene: 1% CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

Other Regulations:

Other Classifications:
WHMIS (Canada):
CLASS B-4: Flammable solid. CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36- Irritating to eyes. R40- Possible risks of irreversible effects. R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed. R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation. R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):
- Health Hazard: 2
- Fire Hazard: 2
- Reactivity: 0
- Personal Protection: E

National Fire Protection Association (U.S.A.):
- Health: 2
- Flammability: 2
- Reactivity: 0
- Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.
Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:30 PM

Last Updated: 11/06/2008 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Butylbenzene
Product Number : B90203
Brand : Aldrich
CAS-No. : 104-51-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 3), H226
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Warning

Hazard statement(s)

H226 : Flammable liquid and vapour.
H410 : Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P210 : Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 : Keep container tightly closed.
P240 : Ground/bond container and receiving equipment.
P241 : Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 : Use only non-sparking tools.
P243 : Take precautionary measures against static discharge.
P273 : Avoid release to the environment.
P280 : Wear protective gloves/ protective clothing/ eye protection/ face shield.
2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms: 1-Phenylbutane

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butylbenzene</td>
<td>Flam. Liq. 3; Aquatic Acute 1;</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Aquatic Chronic 1; H226, H410</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
5.3 **Advice for firefighters**
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 **Further information**
Use water spray to cool unopened containers.

6. **ACCIDENTAL RELEASE MEASURES**

6.1 **Personal precautions, protective equipment and emergency procedures**
Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 **Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 **Methods and materials for containment and cleaning up**
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 **Reference to other sections**
For disposal see section 13.

7. **HANDLING AND STORAGE**

7.1 **Precautions for safe handling**
Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 **Conditions for safe storage, including any incompatibilities**
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

8. **EXPOSURE CONTROLS/PERSONAL PROTECTION**

8.1 **Control parameters**

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 **Exposure controls**

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Impervious clothing, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

- **a) Appearance**
  - Form: liquid, clear
  - Colour: colourless

- **b) Odour**
  - No data available

- **c) Odour Threshold**
  - No data available

- **d) pH**
  - No data available

- **e) Melting point/freezing point**
  - Melting point/range: -88 °C (-126 °F) - lit.

- **f) Initial boiling point and boiling range**
  - 183 °C (361 °F) - lit.

- **g) Flash point**
  - 59.0 °C (138.2 °F) - closed cup

- **h) Evaporation rate**
  - No data available

- **i) Flammability (solid, gas)**
  - No data available

- **j) Upper/lower flammability or explosive limits**
  - Upper explosion limit: 5.8 %(V)
  - Lower explosion limit: 0.8 %(V)

- **k) Vapour pressure**
  - No data available

- **l) Vapour density**
  - No data available

- **m) Relative density**
  - 0.86 g/cm3 at 25 °C (77 °F)

- **n) Water solubility**
  - Insoluble

- **o) Partition coefficient: n-octanol/water**
  - $\text{log Pow$: 4.26}$

- **p) Auto-ignition temperature**
  - 412.0 °C (773.6 °F)

- **q) Decomposition temperature**
  - No data available

- **r) Viscosity**
  - No data available
9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available
Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CY9070000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to daphnia and other aquatic invertebrates
Immobilization EC50 - Daphnia magna (Water flea) - 0.34 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2709       Class: 3       Packing group: III
Proper shipping name: Butyl benzenes
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 2709       Class: 3       Packing group: III
Proper shipping name: BUTYLBENZENES
Marine pollutant:yes

IATA
UN number: 2709       Class: 3       Packing group: III
Proper shipping name: Butylbenzenes

EMS-No: F-E, S-D
15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butylbenzene</td>
<td>104-51-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butylbenzene</td>
<td>104-51-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butylbenzene</td>
<td>104-51-8</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute         Acute aquatic toxicity
Aquatic Chronic       Chronic aquatic toxicity
Flam. Liq.            Flammable liquids
H226                 Flammable liquid and vapour.
H400                 Very toxic to aquatic life.
H410                 Very toxic to aquatic life with long lasting effects.

HMIS Rating
Health hazard: 0
Chronic Health Hazard: 2
Flammability: 0
Physical Hazard 0

NFPA Rating
Health hazard: 0
Fire Hazard: 2
Reactivity Hazard: 0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
SAFETY DATA SHEET

1. Identification

Product Name: Nickel, powder

Cat No.: AC193610000; AC193610250; AC193611000; AC193615000

Synonyms: Raney alloy

Recommended Use: Laboratory chemicals.

Uses advised against: No Information available

Details of the supplier of the safety data sheet

Company: Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name: Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information US call: 001-800-ACROS-01
/ Europe call: +32 14 57 52 11
Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99
CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Skin Sensitization</th>
<th>Category 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogenicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 1</td>
</tr>
<tr>
<td>Target Organs - Kidney, Blood.</td>
<td></td>
</tr>
</tbody>
</table>

Label Elements

Signal Word: Danger

Hazard Statements
May cause an allergic skin reaction
Causes damage to organs through prolonged or repeated exposure
Suspected of causing cancer

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Wear protective gloves/protective clothing/eye protection/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Contaminated work clothing should not be allowed out of the workplace

Response
IF exposed or concerned: Get medical attention/advice
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation or rash occurs: Get medical advice/attention
Wash contaminated clothing before reuse

Storage
Store locked up

Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>7440-02-0</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation
Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

Ingestion
Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects
May cause allergic skin reaction. Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media
No information available

Flash Point
No information available

Method -
No information available

Autoignition Temperature
400 °C / 752 °F

Explosion Limits
Upper
No data available
Lower
No data available
Sensitivity to Mechanical Impact: No information available
Sensitivity to Static Discharge: No information available

Specific Hazards Arising from the Chemical
Combustible material.

Hazardous Combustion Products
Nickel oxides.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas. Avoid dust formation.

Environmental Precautions
Should not be released into the environment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

7. Handling and storage

Handling
Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid dust formation. Do not breathe vapors/dust. Do not ingest.

Storage
Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>TWA: 1.5 mg/m³</td>
<td>(Vacated) TWA: 1 mg/m³ TWA: 1 mg/m³</td>
<td>IDLH: 10 mg/m³ TWA: 0.015 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Quebec</th>
<th>Mexico OEL (TWA)</th>
<th>Ontario TWAEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>TWA: 1 mg/m³</td>
<td>TWA: 1 mg/m³</td>
<td>TWA: 1 mg/m³</td>
</tr>
</tbody>
</table>

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures
Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection
Wear appropriate protective gloves and clothing to prevent skin exposure.
9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Brown</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>1455 °C / 2651 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>2730 °C / 4946 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>No data available</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

Reactive Hazard: None known, based on information available

Stability: Stable under normal conditions.


Incompatible Materials: Strong oxidizing agents

Hazardous Decomposition Products: Nickel oxides

Hazardous Polymerization: Hazardous polymerization does not occur.

Hazardous Reactions: None under normal processing.

11. Toxicological information

Acute Toxicity

<table>
<thead>
<tr>
<th>Component Information</th>
<th>LD50 Oral (Rat)</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>9000 mg/kg</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products: No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure: No information available

Irritation: No information available
Sensitization
May cause sensitization by skin contact. Nickel and nickel compounds may cause a form of dermatitis known as nickel itch. May cause an allergic skin reaction.

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>7440-02-0</td>
<td>Group 2B</td>
<td>Reasonably Anticipated</td>
<td>Not listed</td>
<td>X</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

IARC: (International Agency for Research on Cancer) Group 2B - Possibly Carcinogenic to Humans

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
None known

STOT - repeated exposure
Kidney Blood

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information
No information available

Other Adverse Effects
See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity
Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Do not empty into drains. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>0.18 mg/L EC50 = 72 h</td>
<td>10.4 mg/L LC50 96 h 1.3 mg/L LC50 96 h 100 mg/L LC50 96 h</td>
<td>Not listed</td>
<td>1 mg/L EC50 = 48 h</td>
</tr>
</tbody>
</table>

Persistence and Degradability
No information available

Bioaccumulation/ Accumulation
No information available.

Mobility
No information available.

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
UN-No: UN3089
Proper Shipping Name: METAL POWDERS, FLAMMABLE, N.O.S.
Hazard Class: 4.1
Packing Group: II

TDG
UN-No: UN3089
Proper Shipping Name: METAL POWDERS, FLAMMABLE, N.O.S.
Hazard Class: 4.1
Packing Group: II

IATA
15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>231-111-4</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>7440-02-0</td>
<td>&gt;95</td>
<td>0.1</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazardous Categorization

- Acute Health Hazard: Yes
- Chronic Health Hazard: Yes
- Fire Hazard: No
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: No

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Clean Air Act

<table>
<thead>
<tr>
<th>Component</th>
<th>HAPS Data</th>
<th>Class 1 Ozone Depleters</th>
<th>Class 2 Ozone Depleters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive
Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>100 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

**California Proposition 65**
This product contains the following Proposition 65 chemicals:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>California Prop. 65</th>
<th>Prop 65 NSRL</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>7440-02-0</td>
<td>Carcinogen</td>
<td>-</td>
<td>Carcinogen</td>
</tr>
</tbody>
</table>

**State Right-to-Know**

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel powder</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**U.S. Department of Transportation**

Reportable Quantity (RQ): N
DOT Marine Pollutant: N
DOT Severe Marine Pollutant: N

**U.S. Department of Homeland Security**
This product does not contain any DHS chemicals.

**Other International Regulations**

Mexico - Grade
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
D2A Very toxic materials

**16. Other information**

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

<table>
<thead>
<tr>
<th>Creation Date</th>
<th>04-Oct-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision Date</td>
<td>10-Feb-2015</td>
</tr>
<tr>
<td>Print Date</td>
<td>10-Feb-2015</td>
</tr>
<tr>
<td>Revision Summary</td>
<td>This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)</td>
</tr>
</tbody>
</table>

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

Product name: Propylbenzene  
Product Number: P52407  
Brand: Aldrich  
Company: Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO  63103  
USA  
Telephone: +1 800-325-5832  
Fax: +1 800-325-5052  
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards  
Combustible Liquid

Target Organs  
Lungs, Eyes, Kidney

GHS Label elements, including precautionary statements

Pictogram

Signal word  
Danger

Hazard statement(s)  
H226  Flammable liquid and vapour.  
H304  May be fatal if swallowed and enters airways.  
H335  May cause respiratory irritation.  
H401  Toxic to aquatic life.

Precautionary statement(s)  
P261  Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.  
P301 + P310  IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.  
P331  Do NOT induce vomiting.

HMIS Classification  
Health hazard: 0  
Chronic Health Hazard: *  
Flammability: 2  
Physical hazards: 0

NFPA Rating  
Health hazard: 1  
Fire: 2  
Reactivity Hazard: 0

Potential Health Effects  
Inhalation: May be harmful if inhaled. May cause respiratory tract irritation.  
Skin: May be harmful if absorbed through skin. May cause skin irritation.  
Eyes: May cause eye irritation.
Ingestion
Aspiration hazard if swallowed - can enter lungs and cause damage. May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : 1-Phenylpropane
Formula : C₉H₁₂
Molecular Weight : 120.19 g/mol

<table>
<thead>
<tr>
<th>Propylbenzene</th>
<th>CAS-No.</th>
<th>EC-No.</th>
<th>Index-No.</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>103-65-1</td>
<td>203-132-9</td>
<td>601-024-00-X</td>
<td>-</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Special protective equipment for fire-fighters
Wear self contained breathing apparatus for fire fighting if necessary.

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

**Conditions for safe storage**
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Store in cool place.

---

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

**Personal protective equipment**

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Hand protection**
For prolonged or repeated contact use protective gloves.

**Eye protection**
Face shield and safety glasses

**Skin and body protection**
Choose body protection according to the amount and concentration of the dangerous substance at the work place.

**Hygiene measures**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**Appearance**

- Form: liquid, clear
- Colour: colourless

**Safety data**

- pH: no data available
- Melting point: -99 °C (-146 °F) - lit.
- Boiling point: 159 °C (318 °F) - lit.
- Flash point: 42.0 °C (107.6 °F) - closed cup
- Ignition temperature: 450 °C (842 °F)
- Lower explosion limit: 0.8 % (V)
- Upper explosion limit: 6 % (V)
- Density: 0.862 g/cm³ at 25 °C (77 °F)
- Water solubility: slightly soluble

---

### 10. STABILITY AND REACTIVITY

**Chemical stability**
Stable under recommended storage conditions.

**Possibility of hazardous reactions**
Vapours may form explosive mixture with air.

**Conditions to avoid**
Heat, flames and sparks.
11. TOXICOLOGICAL INFORMATION

Acute toxicity
LD50 Oral - rat - 6,040 mg/kg

LC50 Inhalation - rat - 2 h - 65000 ppm

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Potential health effects
Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion Aspiration hazard if swallowed - can enter lungs and cause damage. May be harmful if swallowed.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.

Signs and Symptoms of Exposure
Damage to the lungs.. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Additional Information
RTECS: DA8750000

12. ECOLOGICAL INFORMATION

Toxicity
Toxicity to fish LC50 - Oncorhynchus mykiss (rainbow trout) - 1.55 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates.

**Immobilization EC50** - Daphnia magna (Water flea) - 2 mg/l - 24 h

**Persistence and degradability**
no data available

**Bioaccumulative potential**
no data available

**Mobility in soil**
no data available

**PBT and vPvB assessment**
no data available

**Other adverse effects**
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Avoid release to the environment.

### 13. DISPOSAL CONSIDERATIONS

**Product**
This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging**
Dispose of as unused product.

### 14. TRANSPORT INFORMATION

**DOT (US)**
- UN-Number: 2364  Class: 3  Packing group: III
- Proper shipping name: n-Propyl benzene
- Marine pollutant: No
- Poison Inhalation Hazard: No

**IMDG**
- UN-Number: 2364  Class: 3  Packing group: III  EMS-No: F-E, S-D
- Proper shipping name: PROPYLBENZENE
- Marine pollutant: No

**IATA**
- UN-Number: 2364  Class: 3  Packing group: III
- Proper shipping name: n-Propylbenzene

### 15. REGULATORY INFORMATION

**OSHA Hazards**
Combustible Liquid

**DSL Status**
All components of this product are on the Canadian DSL list.

**SARA 302 Components**
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Fire Hazard
Massachusetts Right To Know Components
Propylbenzene
CAS-No. 103-65-1
Revision Date 2007-03-01

Pennsylvania Right To Know Components
Propylbenzene
CAS-No. 103-65-1
Revision Date 2007-03-01

New Jersey Right To Know Components
Propylbenzene
CAS-No. 103-65-1
Revision Date 2007-03-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information
Copyright 2010 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
1. PRODUCT AND COMPANY IDENTIFICATION

Product name : o-Xylene
Product Number : 95660
Brand : Fluka
Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052
Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555
Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Flammable liquid, Harmful by skin absorption., Irritant, Reproductive hazard

Target Organs
Liver, Kidney, Nerves.

GHS Classification
Flammable liquids (Category 3)
Acute toxicity, Inhalation (Category 4)
Acute toxicity, Dermal (Category 4)
Skin irritation (Category 2)
Acute aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H226 Flammable liquid and vapour.
H312 + H332 Harmful in contact with skin or if inhaled
H315 Causes skin irritation.
H401 Toxic to aquatic life.

Precautionary statement(s)
P280 Wear protective gloves/ protective clothing.

HMIS Classification
Health hazard: 2
Chronic Health Hazard: *
Flammability: 3
Physical hazards: 1
NFPA Rating
  Health hazard: 2
  Fire: 3
  Reactivity Hazard: 0

Potential Health Effects
  Inhalation  May be harmful if inhaled. Causes respiratory tract irritation.
  Skin  Causes skin irritation.
  Eyes  Causes eye irritation.
  Ingestion  May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: 1,2-Dimethylbenzene

Formula: C₈H₁₀

Molecular Weight: 106.17 g/mol

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>o-Xylene</td>
<td></td>
</tr>
<tr>
<td>CAS-No.</td>
<td>95-47-6</td>
</tr>
<tr>
<td>EC-No.</td>
<td>202-422-2</td>
</tr>
<tr>
<td>Index-No.</td>
<td>601-022-00-9</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES
Personal precautions
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>o-Xylene</td>
<td>95-47-6</td>
<td>STEL</td>
<td>150 ppm 655 mg/m³</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>100 ppm 435 mg/m³</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>100 ppm 434 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks
Not classifiable as a human carcinogen

TWA 100 ppm USA. ACGIH Threshold Limit Values (TLV)

Eye & Upper Respiratory Tract irritation Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen

STEL 150 ppm USA. ACGIH Threshold Limit Values (TLV)

Eye & Upper Respiratory Tract irritation Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen

TWA 100 ppm 435 mg/m³ USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

TWA 100 ppm 435 mg/m³ USA. NIOSH Recommended Exposure Limits

ST 150 ppm 655 mg/m³ USA. NIOSH Recommended Exposure Limits

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: > 480 min
Material tested: Vitoject® (Aldrich Z677698, Size M)

Splash protection
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: > 30 min
Material tested: Camatril® (Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance
Form liquid
Colour colourless

Safety data
pH no data available
Melting point/freezing point Melting point/range: -26 - -23 °C (-15 - -9 °F) - lit.
Boiling point 143 - 145 °C (289 - 293 °F) - lit.
Flash point 31.0 °C (87.8 °F) - closed cup
Ignition temperature 464 °C (867 °F)
Autoignition temperature 464.0 °C (867.2 °F)
Lower explosion limit 0.9 % (V)
Upper explosion limit 6.7 % (V)
Vapour pressure 21.3 hPa (16.0 mmHg) at 37.7 °C (99.9 °F)
8.8 hPa (6.6 mmHg) at 25.0 °C (77.0 °F)
Density 0.879 g/mL at 20 °C (68 °F)
Water solubility no data available
Partition coefficient: log Pow: 3.12
n-octanol/water
Relative vapour density no data available
Odour no data available
Odour Threshold no data available
Evaporation rate no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
Vapours may form explosive mixture with air.

Conditions to avoid
Heat, flames and sparks.

Materials to avoid
Oxidizing agents

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity
Oral LD50 no data available
Inhalation LC50 no data available
Dermal LD50 no data available

Other information on acute toxicity
LD50 Intraperitoneal - mouse - 1,364 mg/kg

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity
This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (o-Xylene)
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a
known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Suspected human reproductive toxicant

Teratogenicity

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion May be harmful if swallowed.
Skin Causes skin irritation.
Eyes Causes eye irritation.

Signs and Symptoms of Exposure
narcosis, Lung irritation, chest pain, pulmonary edema, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Liver injury may occur., Kidney injury may occur., Blood disorders

Synergistic effects
no data available

Additional Information
RTECS: ZE2450000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish LC50 - Lepomis macrochirus (Bluegill) - 16.10 mg/l - 96 h
LC50 - Carassius auratus (goldfish) - 13.00 mg/l - 24 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 1.39 - 1.87 mg/l - 48 h

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 4.70 mg/l - 72 h
EC50 - Chlorella vulgaris (Fresh water algae) - 55.00 mg/l - 24 h

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available
Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1307  Class: 3  Packing group: III  Proper shipping name: Xylenes  Reportable Quantity (RQ): 100 lbs  Marine pollutant: No  Poison Inhalation Hazard: No

IMDG
UN number: 1307  Class: 3  Packing group: III  Proper shipping name: XYLENES  Marine pollutant: No  EMS-No: F-E, S-D

IATA
UN number: 1307  Class: 3  Packing group: III  Proper shipping name: Xylenes

15. REGULATORY INFORMATION

OSHA Hazards
Flammable liquid, Harmful by skin absorption., Irritant, Reproductive hazard

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>o-Xylene</td>
<td>95-47-6</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
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<th>Component</th>
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Pennsylvania Right To Know Components

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New Jersey Right To Know Components

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<tr>
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<td>95-47-6</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>
California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information
Copyright 2012 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
MATERIAL SAFETY DATA SHEET
(POLYCHLORINATED BIPHENYLS)

COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name: polychlorinated biphenyls (PCBs)

HAZARD IDENTIFICATION

Reports of Carcinogenicity: YES

HEALTH HAZARDS ACUTE AND CHRONIC

- **Eyes**: Moderately irritating to eye tissues.
- **Skin**: Can be absorbed through intact skin, may cause de-fatting, potential for chloracne.
- **Inhalation**: Possible liver injury.
- **Ingestion**: Slightly toxic; reasonably anticipated to be carcinogenic.

EFFECTS OF OVER-EXPOSURE

Can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

FIRST AID MEASURES

- **Eyes**: Irrigate immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them.
- **Skin**: Contaminated clothing should be removed and the skin washed thoroughly with soap and water. Hot PCBs may cause thermal burns.
- **Inhalation**: Remove to fresh air; if skin rash or respiratory irritation persists, consult a physician (if electrical equipment arcs over, PCBs may decompose to produce hydrochloric acid).
- **Ingestion**: Consult a physician. Do not induce vomiting or give any oily laxatives. (If large amounts are ingested, gastric lavage is suggested).

FIRE FIGHTING MEASURES: Flash Point: >141 °C (285.8 °F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.
FIRE-FIGHTING PROCEDURES

Standard fire-fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

UNUSUAL FIRE/EXPLOSION HAZARD

If a PCB transformer is involved in a fire-related incident, the owner of the transformer is required to report the incident. Consult and follow appropriate federal, provincial and local regulations.

*Note:* When askarel liquid becomes involved in a fire, toxic by-products of combustion are typically produced including polychlorinated dibenzofurans and polychlorinated dibenzodioxins, both known carcinogens. The structures of these chemical species are as follows:

\[
\text{TCDF} \quad \text{C}_{12} \text{H}_{8-n}\text{Cl}_n\text{O} \\
\text{n} = 4 - 8
\]

\[
\text{2,3,7,8-tetrachlorodibenzo-furan}
\]

\[
\text{TCDD} \quad \text{C}_{12} \text{H}_{8-n}\text{Cl}_n\text{O}_2 \\
\text{n} = 4 - 8
\]

\[
\text{2,3,7,8-tetrachloro-dibenzo-p-dioxin}
\]

*Note:* 2,3,7,8-tetrachloro-dibenzo-p-dioxin is one of the most potent teratogenic, mutagenic and carcinogenic agents known to man.

SPILL RELEASE PROCEDURES

Cleanup & disposal of liquid PCBs are strictly regulated by the federal government. Ventilate area. Contain spill/leak. Remove spill by means of absorptive material. Spill clean-up personnel should use proper protective clothing. All wastes and residues containing PCBs should be collected, containerized, marked and disposed of in the manner prescribed by applicable federal, provincial and local laws.

HANDLING AND STORAGE PRECAUTIONS

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid. Avoid prolonged breathing of vapours or mists. Avoid contact with eyes or prolonged contact with skin. Comply with all federal, provincial and local regulations.
OTHER PRECAUTIONS

Federal regulations require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be appropriately labelled.

RESPIRATORY PROTECTION

Use OHSA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by the manufacturer must be observed.

VENTILATION

Provide natural or mechanical ventilation to control exposure levels below airborne exposure levels.

PROTECTIVE GLOVES: Wear appropriate chemical resistant gloves to prevent skin contact.

EYE PROTECTION: Wear chemical splash goggles and have eye baths available.

OTHER PROTECTIVE EQUIPMENT

Wear appropriate protective clothing. Provide a safety shower at any location where skin contact can occur.

WORK HYGIENIC PRACTICES

Wash thoroughly after handling. Supplemental safety and health: none

PHYSICAL/ CHEMICAL PROPERTIES

- **Vapour pressure:** (mm Hg @ 100 °F) 0.005 - 0.00006
- **Viscosity:** (CENTISTOKES) 3.6 - 540
- **Stability indicator/materials to avoid:** Yes
- **Stability Condition to Avoid:** PCBs are very stable, fire-resistant compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide, hydrogen chloride, phenolics, aldehydes, furans, dioxins

WASTE DISPOSAL METHODS

Consult the applicable PCB regulations prior to any disposal of PCBs or PCB-contaminated items.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: \( p \)-Cresol
Product Number: W233706
Brand: Aldrich
Index-No.: 604-004-00-9
CAS-No.: 106-44-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 3), H311
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Danger</th>
</tr>
</thead>
</table>

Hazard statement(s)
H301 + H311: Toxic if swallowed or in contact with skin
H314: Causes severe skin burns and eye damage.
H411: Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P260: Do not breathe dust or mist.
P264: Wash skin thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/ physician.
P322 Specific measures (see supplemental first aid instructions on this label).
P361 Remove/Take off immediately all contaminated clothing.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : 4-Methylphenol

Formula : C₇H₈O

Molecular weight : 108.14 g/mol
CAS-No. : 106-44-5
EC-No. : 203-398-6
Index-No. : 604-004-00-9

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cresol</td>
<td>Acute Tox. 3; Skin Corr. 1B;</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Eye Dam. 1; Aquatic Acute 2;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aquatic Chronic 2; H301 + H311, H314, H411</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
hygroscopic Air and light sensitive. Handle and store under inert gas.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PATRSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Cresol</td>
<td>106-44-5</td>
<td>TWA</td>
<td>2.3 ppm 10 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5 ppm 22 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

Remarks
Skin designation
The value in mg/m3 is approximate.
### 8.2 Exposure controls

**Appropriate engineering controls**
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 30 min
Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Form: crystalline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>colourless</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Odour</th>
<th>No data available</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Odour Threshold</th>
<th>No data available</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>pH</th>
<th>No data available</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Melting point/freezing</th>
<th>Melting point/range: 31 - 37 °C (88 - 99 °F)</th>
</tr>
</thead>
</table>

---
Melting point/range: 32 - 34 °C (90 - 93 °F) - lit.

Initial boiling point and boiling range: 202 °C (396 °F) - lit.

Flash point: 85.0 °C (185.0 °F) - closed cup

Evaporation rate: No data available

Flammability (solid, gas): No data available

Upper/lower flammability or explosive limits: Lower explosion limit: 1.1 %(V)

Vapour pressure: 1.3 hPa (1.0 mmHg) at 20.0 °C (68.0 °F)

Vapour density: No data available

Relative density: 1.034 g/cm3 at 25 °C (77 °F)

Water solubility: No data available

Partition coefficient: n-octanol/water: log Pow: 1.94

Auto-ignition temperature: 559.0 °C (1,038.2 °F)

Decomposition temperature: No data available

Viscosity: No data available

Explosive properties: No data available

Oxidizing properties: No data available

Other safety information: No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, Bases

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 207.0 mg/kg
LC50 Inhalation - Rat - 1 h - > 710 mg/m3
LD50 Dermal - Rabbit - 301.0 mg/kg

No data available

**Skin corrosion/irritation**
Skin - Rabbit
Result: Severe skin irritation - 24 h

**Serious eye damage/eye irritation**
Eyes - Rabbit
Result: Severe eye irritation

**Respiratory or skin sensitisation**
No data available

**Germ cell mutagenicity**
No data available

**Carcinogenicity**
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

**Specific target organ toxicity - single exposure**
No data available

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available

**Additional Information**
RTECS: GO6475000
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, laryngitis, Dizziness, Cardiovascular effects., Muscle cramps/spasms., Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Kidney -

---

**12. ECOLOGICAL INFORMATION**

**12.1 Toxicity**

Toxicity to fish
LC50 - other fish - 16.00 - 24.00 mg/l - 24 h
LC50 - Oncorhynchus mykiss (rainbow trout) - 7.9 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates
LC50 - Daphnia magna (Water flea) - 1.4 mg/l - 48 h

**12.2 Persistence and degradability**
No data available

**12.3 Bioaccumulative potential**
Does not bioaccumulate.
12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3455 Class: 6.1 (8) Packing group: II
Proper shipping name: Cresols, solid
Reportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3455 Class: 6.1 (8) Packing group: II EMS-No: F-A, S-B
Proper shipping name: CRESOLS, SOLID

IATA
UN number: 3455 Class: 6.1 (8) Packing group: II
Proper shipping name: Cresols, solid

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

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<td>2007-07-01</td>
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SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

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Pennsylvania Right To Know Components

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New Jersey Right To Know Components

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<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>106-44-5</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

### 16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| Acute Tox. | Acute toxicity          |
| Aquatic Acute | Acute aquatic toxicity  |
| Aquatic Chronic | Chronic aquatic toxicity |
| Eye Dam. | Serious eye damage       |
| H301 | Toxic if swallowed.  |
| H301 + H311 | Toxic if swallowed or in contact with skin |
| H311 | Toxic in contact with skin. |
| H314 | Causes severe skin burns and eye damage. |

**HMIS Rating**
- Health hazard: 3
- Chronic Health Hazard: 0
- Flammability: 0
- Physical Hazard: 0

**NFPA Rating**
- Health hazard: 3
- Fire Hazard: 2
- Reactivity Hazard: 0

**Further information**

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**Preparation Information**

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956  
Version: 4.10  Revision Date: 11/12/2015  Print Date: 02/07/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: 4-Ethyltoluene
Product Number: E49800
Brand: Aldrich
CAS-No.: 622-96-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 3), H226
Aspiration hazard (Category 1), H304

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353  IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P331  Do NOT induce vomiting.
P370 + P378  In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235  Store in a well-ventilated place. Keep cool.
P405  Store locked up.
P501  Dispose of contents/ container to an approved waste disposal plant.

2.3  Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1  Substances
Formula: C₉H₁₂
Molecular Weight: 120.19 g/mol
CAS-No.: 622-96-8
EC-No.: 210-761-2

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Ethyltoluene</td>
<td>Flam. Liq. 3; Asp. Tox. 1; H226, H304</td>
<td>-</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1  Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2  Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3  Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1  Extinguishing media

Suitable extinguishing media
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2  Special hazards arising from the substance or mixture
Carbon oxides

5.3  Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.
Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)
data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Appearance</td>
<td>Form: clear, liquid</td>
</tr>
<tr>
<td></td>
<td>Colour: light yellow</td>
</tr>
<tr>
<td>b) Odour</td>
<td>no data available</td>
</tr>
<tr>
<td>c) Odour Threshold</td>
<td>no data available</td>
</tr>
<tr>
<td>d) pH</td>
<td>no data available</td>
</tr>
<tr>
<td>e) Melting point/freezing point</td>
<td>no data available</td>
</tr>
<tr>
<td>f) Initial boiling point and boiling range</td>
<td>162 °C (324 °F) - lit.</td>
</tr>
<tr>
<td>g) Flash point</td>
<td>43 °C (109 °F) - closed cup</td>
</tr>
<tr>
<td>h) Evaporation rate</td>
<td>no data available</td>
</tr>
<tr>
<td>i) Flammability (solid, gas)</td>
<td>no data available</td>
</tr>
<tr>
<td>j) Upper/lower flammability or explosive limits</td>
<td>no data available</td>
</tr>
<tr>
<td>k) Vapour pressure</td>
<td>no data available</td>
</tr>
<tr>
<td>l) Vapour density</td>
<td>no data available</td>
</tr>
<tr>
<td>m) Relative density</td>
<td>0.861 g/cm3 at 25 °C (77 °F)</td>
</tr>
<tr>
<td>n) Water solubility</td>
<td>no data available</td>
</tr>
<tr>
<td>o) Partition coefficient: n-octanol/water</td>
<td>no data available</td>
</tr>
<tr>
<td>p) Auto-ignition temperature</td>
<td>no data available</td>
</tr>
<tr>
<td>q) Decomposition temperature</td>
<td>no data available</td>
</tr>
<tr>
<td>r) Viscosity</td>
<td>no data available</td>
</tr>
<tr>
<td>s) Explosive properties</td>
<td>no data available</td>
</tr>
</tbody>
</table>
t) Oxidizing properties no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 4,850 mg/kg
Inhalation: no data available
Dermal: no data available
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity
mouse
Sister chromatid exchange

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available
Reproductive toxicity - rat - Oral
Maternal Effects: Other effects. Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

no data available

**Specific target organ toxicity - single exposure**
no data available

**Specific target organ toxicity - repeated exposure**
no data available

**Aspiration hazard**
The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.

**Additional Information**
RTECS: XT2550000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

---

### 12. ECOLOGICAL INFORMATION

12.1 **Toxicity**
no data available

12.2 **Persistence and degradability**
no data available

12.3 **Bioaccumulative potential**
no data available

12.4 **Mobility in soil**
no data available

12.5 **Results of PBT and vPvB assessment**
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 **Other adverse effects**
no data available

---

### 13. DISPOSAL CONSIDERATIONS

13.1 **Waste treatment methods**

**Product**
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

**Contaminated packaging**
Dispose of as unused product.

---

### 14. TRANSPORT INFORMATION

**DOT (US)**
UN number: 3295  Class: 3  Packing group: III
Proper shipping name: Hydrocarbons, liquid, n.o.s.
Marine pollutant: No
Poison Inhalation Hazard: No

**IMDG**
UN number: 3295  Class: 3  Packing group: III  EMS-No: F-E, S-D
Proper shipping name: HYDROCARBONS, LIQUID, N.O.S.
Marine pollutant: No

**IATA**
15. REGULATORY INFORMATION

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>622-96-8</td>
<td></td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>622-96-8</td>
<td></td>
</tr>
</tbody>
</table>

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Asp. Tox.  Aspiration hazard
Flam. Liq.  Flammable liquids
H226      Flammable liquid and vapour.
H304      May be fatal if swallowed and enters airways.

HMIS Rating
Health hazard: 1
Chronic Health Hazard:
Flammability: 2
Physical Hazard: 0

NFPA Rating
Health hazard: 0
Fire Hazard: 2
Reactivity Hazard: 0

Further information
Copyright 2014 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
1. Identification

Product Name: Phenanthrene

Cat No.: AC130090000; AC130090050; AC130090500; AC130095000

Synonyms: No information available

Recommended Use: Laboratory chemicals.

Uses advised against: No Information available

Details of the supplier of the safety data sheet

Company: Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name: Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number: For information US call: 001-800-ACROS-01
Europe: +32 14 57 52 11
Emergency Number US: 001-201-796-7100
Europe: +32 14 57 52 99
CHEMTREC Tel. No.
US: 001-800-424-9300
Europe: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity Category 4

Label Elements

Signal Word: Warning

Hazard Statements
Harmful if swallowed

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazard not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

### 3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>85-01-8</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

### 4. First-aid measures

**General Advice**
If symptoms persist, call a physician.

**Eye Contact**
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

**Skin Contact**
Obtain medical attention. Wash off immediately with plenty of water for at least 15 minutes.

**Inhalation**
Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

**Ingestion**
Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.

**Most important symptoms/effects**
None reasonably foreseeable.

**Notes to Physician**
Treat symptomatically

### 5. Fire-fighting measures

**Suitable Extinguishing Media**
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**Unsuitable Extinguishing Media**
No information available

**Flash Point**
No information available

**Method**
No information available

**Autoignition Temperature**
Not applicable

**Explosion Limits**
Upper
No data available

Lower
No data available

**Sensitivity to Mechanical Impact**
No information available

**Sensitivity to Static Discharge**
No information available

**Specific Hazards Arising from the Chemical**
Do not allow run-off from fire fighting to enter drains or water courses.

**Hazardous Combustion Products**
Carbon monoxide (CO) Carbon dioxide (CO₂)

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 6. Accidental release measures

**Personal Precautions**
Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.
Environmental Precautions
Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling
Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Avoid dust formation.

Storage
Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines
This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Engineering Measures
Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment
Eye/face Protection
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection
Long sleeved clothing.

Respiratory Protection
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Solid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Beige</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>95 - 101 °C / 203 - 213.8 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>336 °C / 636.8 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>1 mmHg @ 116 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Relative Density</td>
<td>1.063</td>
</tr>
<tr>
<td>Solubility</td>
<td>Insoluble in water</td>
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<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>C14 H10</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>178.23</td>
</tr>
</tbody>
</table>

10. Stability and reactivity
Phenanthrene

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid

Incompatible Materials
Strong oxidizing agents

Hazardous Decomposition Products
Carbon monoxide (CO), Carbon dioxide (CO₂)

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>1.8 g/kg (Rat)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
No information available

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>85-01-8</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
None known

STOT - repeated exposure
None known

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
</table>
Phenanthrene

Persistence and Degradability
- Insoluble in water
- May persist

Bioaccumulation/ Accumulation
- No information available.

Mobility
- Is not likely mobile in the environment due to its low water solubility.

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>4.46</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods
- Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

<table>
<thead>
<tr>
<th>DOT</th>
<th>Pro_</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN-No</td>
<td>UN3077</td>
<td>ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.</td>
<td>III</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDG</th>
<th>Pro_</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN-No</td>
<td>UN3077</td>
<td>ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.</td>
<td>III</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IATA</th>
<th>Pro_</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN-No</td>
<td>UN3077</td>
<td>ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.*</td>
<td>III</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMDG/IMO</th>
<th>Pro_</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN-No</td>
<td>UN3077</td>
<td>ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.</td>
<td>III</td>
</tr>
</tbody>
</table>

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>201-581-5</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
- X - Listed
- E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
- F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
- N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
- P - Indicates a commenced PMN substance
- R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
- S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
- T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
- XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
- Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
- Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.
U.S. Federal Regulations

TSCA 12(b)  Not applicable

SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>85-01-8</td>
<td>&gt;95</td>
<td>1.0</td>
</tr>
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</table>

SARA 311/312 Hazardous Categorization

<table>
<thead>
<tr>
<th>Category</th>
<th>Phenanthrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Health Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td>No</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>No</td>
</tr>
<tr>
<td>Sudden Release of Pressure Hazard</td>
<td>No</td>
</tr>
<tr>
<td>Reactive Hazard</td>
<td>No</td>
</tr>
</tbody>
</table>

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Clean Air Act  Not applicable

OSHA  Occupational Safety and Health Administration  Not applicable

CERCLA  This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>5000 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

California Proposition 65  This product does not contain any Proposition 65 chemicals

State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenanthrene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Phenanthrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reportable Quantity (RQ):</td>
<td>N</td>
</tr>
<tr>
<td>DOT Marine Pollutant</td>
<td>N</td>
</tr>
<tr>
<td>DOT Severe Marine Pollutant</td>
<td>N</td>
</tr>
</tbody>
</table>

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade  No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class  Non-controlled

16. Other information

Prepared By  Regulatory Affairs
Phenanthrene

Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 01-May-2012
Revision Date 11-Aug-2014
Print Date 11-Aug-2014
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
Material Safety Data Sheet
Phenol MSDS

Section 1: Chemical Product and Company Identification

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>Phenol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog Codes:</td>
<td>SLP4453, SLP5251</td>
</tr>
<tr>
<td>CAS#:</td>
<td>108-95-2</td>
</tr>
<tr>
<td>RTECS:</td>
<td>SJ3325000</td>
</tr>
<tr>
<td>TSCA:</td>
<td>TSCA 8(b) inventory: Phenol</td>
</tr>
<tr>
<td>CI#:</td>
<td>Not available.</td>
</tr>
<tr>
<td>Synonym:</td>
<td>Monohydroxybenzene; Benzenol; Phenyl hyroxide; Phenyl acid</td>
</tr>
<tr>
<td>Chemical Name:</td>
<td>Carbolic Acid</td>
</tr>
<tr>
<td>Chemical Formula:</td>
<td>C6H5OH</td>
</tr>
<tr>
<td>Contact Information:</td>
<td></td>
</tr>
<tr>
<td>Sciencelab.com, Inc.</td>
<td></td>
</tr>
<tr>
<td>14025 Smith Rd.</td>
<td></td>
</tr>
<tr>
<td>Houston, Texas 77396</td>
<td></td>
</tr>
<tr>
<td>US Sales: 1-800-901-7247</td>
<td></td>
</tr>
<tr>
<td>International Sales: 1-281-441-4400</td>
<td></td>
</tr>
<tr>
<td>Order Online: ScienceLab.com</td>
<td></td>
</tr>
<tr>
<td>CHEMTREC (24HR Emergency Telephone), call:</td>
<td></td>
</tr>
<tr>
<td>1-800-424-9300</td>
<td></td>
</tr>
<tr>
<td>International CHEMTREC, call: 1-703-527-3887</td>
<td></td>
</tr>
<tr>
<td>For non-emergency assistance, call: 1-281-441-4400</td>
<td></td>
</tr>
</tbody>
</table>

Section 2: Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenol</td>
<td>108-95-2</td>
<td>100</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Phenol: ORAL (LD50): Acute: 317 mg/kg [Rat]. 270 mg/kg [Mouse]. DERMAL (LD50): Acute: 630 mg/kg [Rabbit]. 669 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (sensitizer, permeator). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human,) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated
exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin
destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.
Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many
human organs.

### Section 4: First Aid Measures

**Eye Contact:**
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15
minutes. Cold water may be used. Get medical attention immediately.

**Skin Contact:**
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing
and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean
shoes before reuse. Get medical attention immediately.

**Serious Skin Contact:**
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical
attention.

**Inhalation:**
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical
attention immediately.

**Serious Inhalation:**
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If
breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may
be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or
corrosive. Seek immediate medical attention.

**Ingestion:**
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious
person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar,
tie, belt or waistband.

**Serious Ingestion:** Not available.

### Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** 715°C (1319°F)

**Flash Points:** CLOSED CUP: 79°C (174.2°F). OPEN CUP: 85°C (185°F).

**Flammable Limits:** LOWER: 1.7% UPPER: 8.6%

**Products of Combustion:** These products are carbon oxides (CO, CO2).

**Fire Hazards in Presence of Various Substances:**
Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in
presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:**
Phenol + nitriles results in heat and flammable gas generation. Phenol + mineral oxidizing acids results in fire. Phenol +
calcium hypochlorite is an exothermic reaction producing toxic fumes which may ignite.
Special Remarks on Explosion Hazards:
Phenol + sodium nitrite causes explosion on heating. Peroxydisulfuric acid + phenol causes explosion.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill: Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.


Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 5 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 19 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 5 from NIOSH [United States] TWA: 19 (mg/m3) from NIOSH [United States] TWA: 5 (ppm) from OSHA (PEL) [United States] TWA: 19 (mg/m3) from OSHA (PEL) [United States] TWA: 5 (ppm) [Canada] TWA: 19 (mg/m3) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Distinct, aromatic, somewhat sickening sweet and acrid

Taste: Burning.
Molecular Weight: 94.11 g/mole

Color: Colorless to light pink

pH (1% soln/water): Not available.

Boiling Point: 182°C (359.6°F)

Melting Point: 42°C (107.6°F)

Critical Temperature: 694.2 (1281.6°F)

Specific Gravity: 1.057 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 3.24 (Air = 1)

Volutility: Not available.

Odor Threshold: 0.048 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 1.5

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks), light, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity:
Extremely corrosive in presence of copper. Slightly corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass, of aluminum.

Special Remarks on Reactivity:
Air and light sensitive. Prone to redden on exposure to light and air. Incompatible with aluminum chloride, peroxydisulfuric acid, acetaldehyde, sodium nitrite, boron trifluoride diethyl ether + 1,3-butadiene, isocyanates, nitriles, mineral oxidizing acids, calcium hypochlorite, halogens, formaldehyde, metals and alloys, lead, zinc, magnesium and their alloys, plastics, rubber, coatings, sodium nitrate + trifluoroacetic acid. Phenol + isocyanates results in heat generation, and violent polymerization. Phenol + 1,3-butadiene and boron trifluoride diethyl ether complex results in intense exothermic reaction. Phenol + acetaldehyde results in violent condensation.

Special Remarks on Corrosivity:
Minor corrosive effect on bronze. Severe corrosive effect on brass.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.
Toxicity to Animals:
Acute oral toxicity (LD₅₀): 270 mg/kg [Mouse]. Acute dermal toxicity (LD₅₀): 630 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant), of ingestion, . Hazardous in case of skin contact (sensitizer, permeator), of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 140 mg/kg LDL [Infant] - Route: Oral; Dose: 10,000 mg/kg

Special Remarks on Chronic Effects on Humans:
Animal: passes through the placental barrier. May cause adverse reproductive effects and birth defects (teratogenic) Embryotoxic and/or foetotoxic in animal. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

---

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC₅₀): 125 mg/l 24 hours [Fish (Goldfish)]. >50 mg/l 1 hours [Fish (Fathead minnow)]. >50 mg/l 24 hours [Fish (Fathead minnow)]. >33 mg/l 72 hours [Fish (Fathead minnow)]. >33 ppm 96 hours [Fish (Fathead minnow)].

BOD₅ and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

---

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

---

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.
Identification: Phenol, solid UNNA: 1671 PG: II

Special Provisions for Transport: Not available.

---

Section 15: Other Regulatory Information

Federal and State Regulations:
6/01/97 SARA 302/304/311/312 extremely hazardous substances: Phenol SARA 313 toxic chemical notification and release reporting: Phenol CERCLA: Hazardous substances.: Phenol: 1000 lbs. (453.6 kg)

Other Regulations:

Other Classifications:

WHMIS (Canada):

DSCL (EEC):
R24/25- Toxic in contact with skin and if swallowed. R34- Causes burns. R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. R52- Harmful to aquatic organisms. S1/2- Keep locked up and out of the reach of children. S24- Avoid contact with skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S56- Dispose of this material and its container at hazardous or special waste collection point.

HMIS (U.S.A.):

Health Hazard: 3
Fire Hazard: 2
Reactivity: 0

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 11:17 AM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Potassium

Product Number: 244864
Brand: Aldrich

CAS-No.: 7440-09-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260
Skin corrosion (Category 1A), H314
Serious eye damage (Category 1), H318
Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H260 In contact with water releases flammable gases which may ignite spontaneously.
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H350 May cause cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
Handle under inert gas. Protect from moisture.
Do not breathe dust or mist.
Wash skin thoroughly after handling.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Use personal protective equipment as required.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
IF exposed or concerned: Get medical advice/ attention.
Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
Wash contaminated clothing before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Store in a dry place. Store in a closed container.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

Reacts violently with water.
May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures
Formula: K
Molecular weight: 39.10 g/mol

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potassium</strong></td>
<td>Water-react. 1; Skin Corr. 1A; Eye Dam. 1; H260, H314</td>
<td>&gt;= 90 - &lt;= 100 %</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>7440-09-7</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>231-119-8</td>
<td></td>
</tr>
<tr>
<td>Index-No.</td>
<td>019-001-00-2</td>
<td></td>
</tr>
<tr>
<td><strong>Paraffin oils</strong></td>
<td>Carc. 1A; H350</td>
<td>&gt;= 1 - &lt; 5 %</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>8012-95-1</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>232-384-2</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.
In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Dry powder

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Potassium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.
Handle and store under inert gas.
Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated
8. EXPOSURE CONTROLS/PERSOAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>STEL 10.000000 mg/m3</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 5.000000 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 5.000000 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST 10.000000 mg/m3</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 5.000000 mg/m3</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA 5.000000 mg/m3</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
</tbody>
</table>

Remarks
- Upper Respiratory Tract irritation 2014 Adoption
  Not classifiable as a human carcinogen
- Upper Respiratory Tract irritation 2014 Adoption
  Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen
- Upper Respiratory Tract irritation Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen
- Upper Respiratory Tract irritation Not classifiable as a human carcinogen
- Upper Respiratory Tract irritation Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen
- Upper Respiratory Tract irritation Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties
a) Appearance Form: Fragments
   Colour: grey
b) Odour No data available
c) Odour Threshold No data available
d) pH No data available
e) Melting point/freezing point Melting point/range: 64 °C (147 °F)
f) Initial boiling point and boiling range 774 °C (1,425 °F) at 1,013 hPa (760 mmHg)
g) Flash point No data available
h) Evaporation rate No data available
i) Flammability (solid, gas) No data available
j) Upper/lower No data available
flammability or explosive limits

k) Vapour pressure 0.12 hPa (0.09 mmHg) at 260 °C (500 °F)
l) Vapour density No data available
m) Relative density 0.860 g/cm³
n) Water solubility No data available
o) Partition coefficient: n-octanol/water No data available
p) Auto-ignition temperature No data available
q) Decomposition temperature No data available
r) Viscosity No data available
s) Explosive properties No data available
t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Reacts violently with water.

10.4 Conditions to avoid
Exposure to moisture

10.5 Incompatible materials
Oxidizing agents, Strong oxidizing agents, Carbon oxides, Reacts violently with water., Reacts with water to generate Hydrogen gas.

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available
Germ cell mutagenicity
No data available

Carcinogenicity
IARC: 1 - Group 1: Carcinogenic to humans (Paraffin oils)
NTP: Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Paraffin oils)
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2257  Class: 4.3  Packing group: I
Proper shipping name: Potassium
Reportable Quantity (RQ):

Poison Inhalation Hazard: No

IMDG
UN number: 2257  Class: 4.3  Packing group: I  EMS-No: F-G, S-N
Proper shipping name: POTASSIUM

IATA
UN number: 2257  Class: 4.3  Packing group: I
Proper shipping name: Potassium
IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>7440-09-7</td>
<td>1993-04-24</td>
</tr>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
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</tr>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

New Jersey Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>7440-09-7</td>
<td>1993-04-24</td>
</tr>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>1987-02-27</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc. Carcinogenicity
Eye Dam. Serious eye damage
H260 In contact with water releases flammable gases which may ignite spontaneously.
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H350 May cause cancer.
Skin Corr. Skin corrosion
Water-react. Substances and mixtures, which in contact with water, emit flammable gases

HMIS Rating
Health hazard: 3
Chronic Health Hazard: *  
Flammability: 4  
Physical Hazard 2  

**NFPA Rating**  
Health hazard: 3  
Fire Hazard: 4  
Reactivity Hazard: 2  
Special hazard.l: W  

**Further information**  
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**Preparation Information**  
Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956  

Version: 3.10  
Revision Date: 03/03/2015  
Print Date: 02/07/2016
SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Identification of the substance: p-Xylene

Article number: 8817

Registration number (REACH): It is not required to list the identified uses because the substance is not subject to registration according to REACH (< 1 t/a)

Index No: 601-022-00-9

EC number: 203-396-5

CAS number: 106-42-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: laboratory chemical laboratory and analytical use

1.3 Details of the supplier of the safety data sheet

Carl Roth GmbH + Co KG
Schoemperlenstr. 3-5
D-76185 Karlsruhe
Germany

Telephone: +49 (0) 721 - 56 06 0
Telefax: +49 (0) 721 - 56 06 149
e-mail: sicherheit@carlroth.de
Website: www.carlroth.de

Competent person responsible for the safety data sheet: Department Health, Safety and Environment

e-mail (competent person): sicherheit@carlroth.de

1.4 Emergency telephone number

Emergency information service: Poison Centre Munich: +49/(0)89 19240

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

<table>
<thead>
<tr>
<th>Classification acc. to GHS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section</strong></td>
</tr>
<tr>
<td>2.6</td>
</tr>
<tr>
<td>3.1D</td>
</tr>
<tr>
<td>3.1I</td>
</tr>
<tr>
<td>3.2</td>
</tr>
</tbody>
</table>
Classification acc. to GHS

<table>
<thead>
<tr>
<th>Section</th>
<th>Hazard class</th>
<th>Hazard class and category</th>
<th>Hazard statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>serious eye damage/eye irritation</td>
<td>(Eye Irrit. 2)</td>
<td>H319</td>
</tr>
<tr>
<td>3.8R</td>
<td>specific target organ toxicity - single exposure (respiratory tract irritation)</td>
<td>(STOT SE 3)</td>
<td>H335</td>
</tr>
<tr>
<td>3.10</td>
<td>aspiration hazard</td>
<td>(Asp. Tox. 1)</td>
<td>H304</td>
</tr>
</tbody>
</table>

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

Signal word | Danger

Pictograms

GHS02, GHS07, GHS08

Hazard statements

H226     Flammable liquid and vapour
H304     May be fatal if swallowed and enters airways
H312+H332 Harmful in contact with skin or if inhaled
H315     Causes skin irritation
H319     Causes serious eye irritation
H335     May cause respiratory irritation

Precautionary statements

Precautionary statements - prevention

P210     Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280     Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statements - response

P301+P310 IF SWALLOWED: Immediately call a doctor.
P302+P352 IF ON SKIN: Wash with plenty of water/...
P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P331     Do NOT induce vomiting.

Labelling of packages where the contents do not exceed 125 ml

Signal word: Danger

Symbol(s)

H304     May be fatal if swallowed and enters airways.
P301+P310 IF SWALLOWED: Immediately call a doctor.
P331     Do NOT induce vomiting.

2.3 Other hazards

There is no additional information.
SECTION 3: Composition/information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Name of substance</th>
<th>1,4-Dimethylbenzene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index No</td>
<td>601-022-00-9</td>
</tr>
<tr>
<td>EC number</td>
<td>203-396-5</td>
</tr>
<tr>
<td>CAS number</td>
<td>106-42-3</td>
</tr>
<tr>
<td>Molecular formula</td>
<td>C₈H₁₀</td>
</tr>
<tr>
<td>Molar mass</td>
<td>106.2 g/mol</td>
</tr>
</tbody>
</table>

SECTION 4: First aid measures

4.1 Description of first aid measures

General notes
Take off contaminated clothing.

Following inhalation
Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact
Rinse skin with water/shower. In case of skin irritation, consult a physician.

Following eye contact
Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart. In case of eye irritation consult an ophthalmologist.

Following ingestion
Rinse mouth immediately and drink plenty of water. Observe aspiration hazard if vomiting occurs. Call a physician immediately.

4.2 Most important symptoms and effects, both acute and delayed

4.3 Indication of any immediate medical attention and special treatment needed
none

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Co-ordinate fire-fighting measures to the fire surroundings
p-Xylene ≥99 %, for synthesis

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel
Use personal protective equipment as required. Avoid contact with skin, eyes and clothes. Do not breathe vapour/spray. Avoidance of ignition sources.

6.2 Environmental precautions
Keep away from drains, surface and ground water. Explosive properties.

6.3 Methods and material for containment and cleaning up

Advises on how to contain a spill
Covering of drains.

Advises on how to clean up a spill
Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases
Place in appropriate containers for disposal. Ventilate affected area.

6.4 Reference to other sections

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Provide adequate ventilation as well as local exhaustion at critical locations. Avoid exposure. When not in use, keep containers tightly closed.

• Measures to prevent fire as well as aerosol and dust generation

Keep away from sources of ignition - No smoking.

Take precautionary measures against static discharge.
p-Xylene ≥99 %, for synthesis

article number: 8817

Advice on general occupational hygiene
Wash hands before breaks and after work. Keep away from food, drink and animal feedingstuffs. When using do not smoke.

7.2 Conditions for safe storage, including any incompatibilities
Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight.

Incompatible substances or mixtures
Observe hints for combined storage.

Consideration of other advice
Ground/bond container and receiving equipment.

Ventilation requirements
Use local and general ventilation.

Specific designs for storage rooms or vessels
Recommended storage temperature: 15 – 25 °C.

7.3 Specific end use(s)
No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

<table>
<thead>
<tr>
<th>Country</th>
<th>Name of agent</th>
<th>CAS No</th>
<th>Identifier</th>
<th>TWA [ppm]</th>
<th>TWA [mg/m³]</th>
<th>STEL [ppm]</th>
<th>STEL [mg/m³]</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>p-xylene</td>
<td>106-42-3</td>
<td>IOELV</td>
<td>50</td>
<td>221</td>
<td>100</td>
<td>442</td>
<td>2000/39/EC</td>
</tr>
<tr>
<td>MT</td>
<td>p-xylene</td>
<td>106-42-3</td>
<td>OELV</td>
<td>50</td>
<td>221</td>
<td>100</td>
<td>442</td>
<td>CAP. 424</td>
</tr>
</tbody>
</table>

Notation
STEL Short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15-minute period (unless otherwise specified)
TWA Time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8 hours time-weighted average (unless otherwise specified)

Relevant DNELs/DMELs/PNECs and other threshold levels

• human health values

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Threshold level</th>
<th>Protection goal, route of exposure</th>
<th>Used in</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNEL</td>
<td>221 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>chronic - systemic effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>442 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>acute - systemic effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>221 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>chronic - local effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>442 mg/m³</td>
<td>human, inhalatory</td>
<td>worker (industry)</td>
<td>acute - local effects</td>
</tr>
<tr>
<td>DNEL</td>
<td>212 mg/kg bw/day</td>
<td>human, dermal</td>
<td>worker (industry)</td>
<td>chronic - systemic effects</td>
</tr>
</tbody>
</table>
Environmental values

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Threshold level</th>
<th>Environmental compartment</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNEC</td>
<td>0,25 mg/l</td>
<td>water</td>
<td>intermittent release</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,044 mg/l</td>
<td>freshwater</td>
<td>short-term (single instance)</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,004 mg/l</td>
<td>marine water</td>
<td>short-term (single instance)</td>
</tr>
<tr>
<td>PNEC</td>
<td>1,6 mg/l</td>
<td>sewage treatment plant (STP)</td>
<td>short-term (single instance)</td>
</tr>
<tr>
<td>PNEC</td>
<td>2,52 mg/kg</td>
<td>freshwater sediment</td>
<td>short-term (single instance)</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,252 mg/kg</td>
<td>marine sediment</td>
<td>short-term (single instance)</td>
</tr>
<tr>
<td>PNEC</td>
<td>0,852 mg/kg</td>
<td>soil</td>
<td>short-term (single instance)</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Individual protection measures (personal protective equipment)

Eye/face protection

Use safety goggles with side protection.

Skin protection

- hand protection
  Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

- type of material
  FKM (fluoro rubber)

- material thickness
  0,4 mm.

- breakthrough times of the glove material
  >480 minutes (permeation: level 6)

- other protection measures
  Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

Respiratory protection

Respiratory protection necessary at: Aerosol or mist formation. Type: A (against organic gases and vapours with a boiling point of > 65 °C, colour code: Brown).

Environmental exposure controls
Keep away from drains, surface and ground water.

### SECTION 9: Physical and chemical properties

#### 9.1 Information on basic physical and chemical properties

**Appearance**
- Physical state: liquid (fluid)
- Colour: colourless
- Odour: characteristic
- Odour threshold: No data available

**Other physical and chemical parameters**
- pH (value): This information is not available.
- Melting point/freezing point: 13,25 °C at 1.013 hPa
- Initial boiling point and boiling range: 138,2 °C at 1.013 hPa
- Flash point: 27 °C at 1.013 hPa
- Evaporation rate: no data available
- Flammability (solid, gas): not relevant (fluid)

**Explosive limits**
- lower explosion limit (LEL): 0,9 vol%
- upper explosion limit (UEL): 7 vol%
- Explosion limits of dust clouds: not relevant

**Vapour pressure**: 8,7 hPa at 20 °C

**Density**: 0,86 g/cm³ at 25 °C

**Vapour density**: This information is not available.

**Bulk density**: Not applicable

**Relative density**: Information on this property is not available.

**Solubility(ies)**
- Water solubility: 170,5 mg/l at 25 °C

**Partition coefficient**
- n-octanol/water (log KOW): 3,15 (pH value: 7, 20 °C) (ECHA)
- Soil organic carbon/water (log KOC): 2,73 (ECHA)

**Decomposition temperature**: no data available

**Viscosity**
- • kinematic viscosity: 0,7012 mm²/s
- • dynamic viscosity: 0,603 mPa s at 25 °C

**Explosive properties**
- Shall not be classified as explosive
SECTION 10: Stability and reactivity

10.1 Reactivity
Risk of ignition. In case of warming: Vapours can form explosive mixtures with air.

10.2 Chemical stability
The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions
Violent reaction with: Oxidisers, Nitric acid, Sulphuric acid, Sulphur

10.4 Conditions to avoid
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

10.5 Incompatible materials
Rubber articles, different plastics

10.6 Hazardous decomposition products
Hazardous combustion products: see section 5.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

<table>
<thead>
<tr>
<th>Exposure route</th>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>inhalation: vapour</td>
<td>LC50</td>
<td>19,8 mg/l/4h</td>
<td>rat</td>
<td>GESTIS</td>
</tr>
<tr>
<td>oral</td>
<td>LD50</td>
<td>3,523 mg/kg</td>
<td>rat</td>
<td>ECHA</td>
</tr>
<tr>
<td>dermal</td>
<td>LD50</td>
<td>12,126 mg/kg</td>
<td>rabbit</td>
<td>ECHA</td>
</tr>
</tbody>
</table>

Skin corrosion/irritation
Causes skin irritation.

Serious eye damage/eye irritation
Causes serious eye irritation.

Respiratory or skin sensitisation
Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties
Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant

- Specific target organ toxicity - single exposure
May cause respiratory irritation.
- Specific target organ toxicity - repeated exposure
Shall not be classified as a specific target organ toxicant (repeated exposure).

Aspiration hazard
May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

- If swallowed
  vomiting, aspiration hazard
- If in eyes
  Causes serious eye irritation
- If inhaled
  irritant effects, cough, breathing difficulties, pulmonary oedema
- If on skin
  causes skin irritation, risk of absorption via the skin

Other information
Other adverse effects: Headache, Vertigo, Dizziness, Nausea, Unconsciousness, Liver and kidney damage, Symptoms can occur only after several hours

SECTION 12: Ecological information

12.1 Toxicity
acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.

Aquatic toxicity (acute)

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50</td>
<td>2.6 mg/l</td>
<td>fish</td>
<td>ECHA</td>
<td>96 h</td>
</tr>
<tr>
<td>ErC50</td>
<td>4.7 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>72 h</td>
</tr>
</tbody>
</table>

Aquatic toxicity (chronic)

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Value</th>
<th>Species</th>
<th>Source</th>
<th>Exposure time</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC50</td>
<td>2.2 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>73 h</td>
</tr>
<tr>
<td>NOEC</td>
<td>1.57 mg/l</td>
<td>aquatic invertebrates</td>
<td>ECHA</td>
<td>21 d</td>
</tr>
<tr>
<td>NOEC</td>
<td>0.44 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>73 h</td>
</tr>
<tr>
<td>growth rate (ErCx) 10%</td>
<td>1.9 mg/l</td>
<td>algae</td>
<td>ECHA</td>
<td>73 h</td>
</tr>
</tbody>
</table>

12.2 Process of degradability
The substance is readily biodegradable.
Theoretical Oxygen Demand: 3,165 mg/mg
Theoretical Carbon Dioxide: 3,316 mg/mg

<table>
<thead>
<tr>
<th>Process</th>
<th>Degradation rate</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide generation</td>
<td>50 %</td>
<td>13 d</td>
</tr>
<tr>
<td>oxygen depletion</td>
<td>90 %</td>
<td>28 d</td>
</tr>
</tbody>
</table>
12.3 Bioaccumulative potential
Does not significantly accumulate in organisms.
- n-octanol/water (log KOW): 3.15 (pH value: 7, 20 °C)
- BCF: >5.5 – <12.2 (ECHA)

12.4 Mobility in soil
- Henry's law constant: 623 Pa m³/mol at 25 °C
- The Organic Carbon normalised adsorption coefficient: 2.73

12.5 Results of PBT and vPvB assessment
Data are not available.

12.6 Other adverse effects
Data are not available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods
This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations.

Sewage disposal-relevant information
Do not empty into drains.

Waste treatment of containers/packagings
It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

Sewage disposal-relevant information
Do not empty into drains.

Waste treatment of containers/packagings
It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste
The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks
Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.
p-Xylene ≥99 %, for synthesis

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SECTION 14: Transport information

14.1 UN number 1307
14.2 UN proper shipping name XYLENES
   Hazardous ingredients p-Xylene
14.3 Transport hazard class(es)
   Class 3 (flammable liquids)
14.4 Packing group III (substance presenting low danger)
14.5 Environmental hazards none (non-environmentally hazardous acc. to the dangerous goods regulations)

14.6 Special precautions for user
Provisions for dangerous goods (ADR) should be complied within the premises.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code
The cargo is not intended to be carried in bulk.

14.8 Information for each of the UN Model Regulations
   • Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN)
     UN number 1307
     Proper shipping name XYLENES
     Particulars in the transport document UN1307, XYLENES, 3, III, (D/E)
     Class 3
     Classification code F1
     Packing group III
     Danger label(s) 3
     Excepted quantities (EQ) E1
     Limited quantities (LQ) 5 L
     Transport category (TC) 3
     Tunnel restriction code (TRC) D/E
     Hazard identification No 30

   • International Maritime Dangerous Goods Code (IMDG)
     UN number 1307
     Proper shipping name XYLENES
     Particulars in the shipper’s declaration UN1307, XYLENES, 3, III, 27°C c.c.
     Class 3
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Marine pollutant -
Packing group III
Danger label(s) 3

Special provisions (SP) 223
Excepted quantities (EQ) E1
Limited quantities (LQ) 5 L
EmS F-E, S-D
Stowage category A

• International Civil Aviation Organization (ICAO-IATA/DGR)

UN number 1307
Proper shipping name Xylenes
Particulars in the shipper's declaration UN1307, Xylenes, 3, III
Class 3
Packing group III
Danger label(s) 3

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Relevant provisions of the European Union (EU)

• Regulation 649/2012/EU concerning the export and import of hazardous chemicals (PIC)
  Not listed.
• Regulation 1005/2009/EC on substances that deplete the ozone layer (ODS)
  Not listed.
• Regulation 850/2004/EC on persistent organic pollutants (POP)
  Not listed.
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### Restrictions according to REACH, Annex XVII

<table>
<thead>
<tr>
<th>Name of substance</th>
<th>CAS No</th>
<th>Wt%</th>
<th>Type of registration</th>
<th>Conditions of restriction</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-Xylene</td>
<td></td>
<td>100</td>
<td>1907/2006/EC annex XVII</td>
<td>R3</td>
<td>3</td>
</tr>
<tr>
<td>p-Xylene</td>
<td></td>
<td>100</td>
<td>1907/2006/EC annex XVII</td>
<td>R40</td>
<td>40</td>
</tr>
</tbody>
</table>

**Legend**

**R3**

1. Shall not be used in:
   - ornamental articles intended to produce light or colour effects by means of different phases, for example in ornamental lamps and ashtrays,
   - tricks and jokes,
   - games for one or more participants, or any article intended to be used as such, even with ornamental aspects,
2. Articles not complying with paragraph 1 shall not be placed on the market.
3. Shall not be placed on the market if they contain a colouring agent, unless required for fiscal reasons, or perfume, or both, if they:
   - can be used as fuel in decorative oil lamps for supply to the general public, and,
   - present an aspiration hazard and are labelled with R65 or H304,
4. Decorative oil lamps for supply to the general public shall not be placed on the market unless they conform to the European Standard on Decorative oil lamps (EN 14059) adopted by the European Committee for Standardisation (CEN).
5. Without prejudice to the implementation of other Community provisions relating to the classification, packaging and labelling of dangerous substances and mixtures, suppliers shall ensure, before the placing on the market, that the following requirements are met:
   a. lamp oils, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked as follows: 'Keep lamps filled with this liquid out of the reach of children'; and, by 1 December 2010, 'Just a sip of lamp oil - or even sucking the wick of lamps - may lead to life-threatening lung damage';
   b. grill lighter fluids, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked by 1 December 2010 as follows: 'Just a sip of grill lighter may lead to life threatening lung damage';
   c. lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are packaged in black opaque containers not exceeding 1 litre by 1 December 2010.
6. No later than 1 June 2014, the Commission shall request the European Chemicals Agency to prepare a dossier, in accordance with Article 69 of the present Regulation with a view to ban, if appropriate, grill lighter fluids and fuel for decorative lamps, labelled R65 or H304, intended for supply to the general public.
7. Natural or legal persons placing on the market for the first time lamp oils and grill lighter fluids, labelled with R65 or H304, shall by 1 December 2011, and annually thereafter, provide data on alternatives to lamp oils and grill lighter fluids labelled R65 or H304 to the competent authority in the Member State concerned. Member States shall make those data available to the Commission.

**R40**

1. Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are intended for supply to the general public for entertainment and decorative purposes such as the following:
   - metallic glitter intended mainly for decoration,
   - artificial snow and frost,
   - ‘whooppee’ cushions,
   - silly string aerosols,
   - imitation excrement,
   - horns for parties,
   - decorative flakes and foams,
   - artificial cobwebs,
   - stink bombs.
2. Without prejudice to the application of other Community provisions on the classification, packaging and labelling of substances, suppliers shall ensure before the placing on the market that the packaging of aerosol dispensers referred to above is marked visibly, legibly and indelibly with:
   - for professional users only.
3. By way of derogation, paragraphs 1 and 2 shall not apply to the aerosol dispensers referred to Article 8 (1a) of Council Directive 75/324/EEC (2).
4. The aerosol dispensers referred to in paragraphs 1 and 2 shall not be placed on the market unless they conform to the requirements indicated.

### Restrictions according to REACH, Title VIII

None.

### List of substances subject to authorisation (REACH, Annex XIV)/SVHC - candidate list

Not listed.
### Seveso Directive

<table>
<thead>
<tr>
<th>No</th>
<th>Dangerous substance/hazard categories</th>
<th>Qualifying quantity (tonnes) for the application of lower and upper-tier requirements</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5c</td>
<td>flammable liquids (cat. 2, 3)</td>
<td>5.000 50.000 51)</td>
<td></td>
</tr>
</tbody>
</table>

**Notation**

51) Flammable liquids, categories 2 or 3 not covered by P5a and P5b

### Directive 75/324/EEC relating to aerosol dispensers

**Filling batch**


<table>
<thead>
<tr>
<th>VOC content</th>
<th>100 % 860 g/l</th>
</tr>
</thead>
</table>

**Directive on industrial emissions (VOCs, 2010/75/EU)**

<table>
<thead>
<tr>
<th>VOC content</th>
<th>100 %</th>
</tr>
</thead>
</table>

**Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) - Annex II**

not listed

**Regulation 166/2006/EC concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)**

not listed

**Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD)**

not listed

**Regulation 98/2013/EU on the marketing and use of explosives precursors**

not listed

**Regulation 111/2005/EC laying down rules for the monitoring of trade between the Community and third countries in drug precursors**

not listed

### National inventories

Substance is listed in the following national inventories:

<table>
<thead>
<tr>
<th>Country</th>
<th>National inventories</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>AICS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>CA</td>
<td>DSL</td>
<td>substance is listed</td>
</tr>
<tr>
<td>CN</td>
<td>IECSC</td>
<td>substance is listed</td>
</tr>
<tr>
<td>EU</td>
<td>ECSI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>EU</td>
<td>REACH Reg.</td>
<td>substance is listed</td>
</tr>
<tr>
<td>JP</td>
<td>CSCL-ENCS</td>
<td>substance is listed</td>
</tr>
</tbody>
</table>
**Safety data sheet**

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

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<table>
<thead>
<tr>
<th>Country</th>
<th>National inventories</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP</td>
<td>ISHA-ENCS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>KR</td>
<td>KECI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>MX</td>
<td>INSQ</td>
<td>substance is listed</td>
</tr>
<tr>
<td>NZ</td>
<td>NZIoC</td>
<td>substance is listed</td>
</tr>
<tr>
<td>PH</td>
<td>PICCS</td>
<td>substance is listed</td>
</tr>
<tr>
<td>TR</td>
<td>CICR</td>
<td>substance is listed</td>
</tr>
<tr>
<td>TW</td>
<td>TCSI</td>
<td>substance is listed</td>
</tr>
<tr>
<td>US</td>
<td>TSCA</td>
<td>substance is listed</td>
</tr>
</tbody>
</table>

**Legend**

- **AICS**: Australian Inventory of Chemical Substances
- **CICR**: Chemical Inventory and Control Regulation
- **CSCL-ENCS**: List of Existing and New Chemical Substances (CSCL-ENCS)
- **DSL**: Domestic Substances List (DSL)
- **ECSI**: EC Substance Inventory (EINECS, ELINCS, NLP)
- **IECSC**: Inventory of Existing Chemical Substances Produced or Imported in China
- **INSQ**: National Inventory of Chemical Substances
- **ISHA-ENCS**: Inventory of Existing and New Chemical Substances (ISHA-ENCS)
- **KECI**: Korea Existing Chemicals Inventory
- **NZIoC**: New Zealand Inventory of Chemicals
- **PICCS**: Philippine Inventory of Chemicals and Chemical Substances
- **REACH Reg.**: REACH registered substances
- **TCSI**: Taiwan Chemical Substance Inventory
- **TSCA**: Toxic Substance Control Act

**15.2 Chemical Safety Assessment**

No Chemical Safety Assessment has been carried out for this substance.

**SECTION 16: Other information**

**Abbreviations and acronyms**

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Description of used abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADN</td>
<td>Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)</td>
</tr>
<tr>
<td>ADR</td>
<td>Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)</td>
</tr>
<tr>
<td>BCF</td>
<td>bioconcentration factor</td>
</tr>
<tr>
<td>CAP. 424</td>
<td>Occupational Health and Safety Authority Act (CAP. 424)</td>
</tr>
<tr>
<td>CAS</td>
<td>Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)</td>
</tr>
<tr>
<td>CLP</td>
<td>Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures</td>
</tr>
<tr>
<td>CMR</td>
<td>Carcinogenic, Mutagenic or toxic for Reproduction</td>
</tr>
<tr>
<td>DGR</td>
<td>Dangerous Goods Regulations (see IATA/DGR)</td>
</tr>
<tr>
<td>DMEL</td>
<td>Derived Minimal Effect Level</td>
</tr>
<tr>
<td>DNEL</td>
<td>Derived No-Effect Level</td>
</tr>
<tr>
<td>EINECS</td>
<td>European Inventory of Existing Commercial Chemical Substances</td>
</tr>
<tr>
<td>ELINCS</td>
<td>European List of Notified Chemical Substances</td>
</tr>
</tbody>
</table>
Safety data sheet
according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

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<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Descriptions of used abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>EmS</td>
<td>Emergency Schedule</td>
</tr>
<tr>
<td>GHS</td>
<td>&quot;Globally Harmonized System of Classification and Labelling of Chemicals&quot; developed by the United Nations</td>
</tr>
<tr>
<td>IATA</td>
<td>International Air Transport Association</td>
</tr>
<tr>
<td>IATA/DGR</td>
<td>Dangerous Goods Regulations (DGR) for the air transport (IATA)</td>
</tr>
<tr>
<td>ICAO</td>
<td>International Civil Aviation Organization</td>
</tr>
<tr>
<td>IMDG</td>
<td>International Maritime Dangerous Goods Code</td>
</tr>
<tr>
<td>Index No</td>
<td>the Index number is the identification code given to the substance in Part 3 of Annex VI to Regulation (EC) No 1272/2008</td>
</tr>
<tr>
<td>IOELV</td>
<td>indicative occupational exposure limit value</td>
</tr>
<tr>
<td>MARPOL</td>
<td>International Convention for the Prevention of Pollution from Ships (abbr. of &quot;Marine Pollutant&quot;)</td>
</tr>
<tr>
<td>NLP</td>
<td>No-Longer Polymer</td>
</tr>
<tr>
<td>PBT</td>
<td>Persistent, Bioaccumulative and Toxic</td>
</tr>
<tr>
<td>PNEC</td>
<td>Predicted No-Effect Concentration</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>REACH</td>
<td>Registration, Evaluation, Authorisation and Restriction of Chemicals</td>
</tr>
<tr>
<td>RID</td>
<td>Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)</td>
</tr>
<tr>
<td>STEL</td>
<td>short-term exposure limit</td>
</tr>
<tr>
<td>SVHC</td>
<td>Substance of Very High Concern</td>
</tr>
<tr>
<td>TWA</td>
<td>time-weighted average</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>vPvB</td>
<td>very Persistent and very Bioaccumulative</td>
</tr>
</tbody>
</table>

Key literature references and sources for data
- Regulation (EC) No. 1272/2008 (CLP, EU GHS)
- Dangerous Goods Regulations (DGR) for the air transport (IATA)
- International Maritime Dangerous Goods Code (IMDG)

List of relevant phrases (code and full text as stated in chapter 2 and 3)

<table>
<thead>
<tr>
<th>Code</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>H226</td>
<td>flammable liquid and vapour</td>
</tr>
<tr>
<td>H304</td>
<td>may be fatal if swallowed and enters airways</td>
</tr>
<tr>
<td>H312</td>
<td>harmful in contact with skin</td>
</tr>
<tr>
<td>H315</td>
<td>causes skin irritation</td>
</tr>
<tr>
<td>H319</td>
<td>causes serious eye irritation</td>
</tr>
<tr>
<td>H332</td>
<td>harmful if inhaled</td>
</tr>
<tr>
<td>H335</td>
<td>may cause respiratory irritation</td>
</tr>
</tbody>
</table>
Disclaimer

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.
SAFETY DATA SHEET

1. Identification

Product Name Pyrene
Cat No.: AC180830000; AC180830250; AC180831000; AC180835000
Synonyms Benzo[def]phenanthrene
Recommended Use Laboratory chemicals.
Uses advised against No Information available
Details of the supplier of the safety data sheet
Company Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100
Entity / Business Name Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410
Emergency Telephone Number
For information US call: 001-800-ACROS-01
Europe call: +32 14 57 52 11
Emergency Number US: 001-201-796-7100 / Europe: +32 14 57 52 99
CHEMTREC Tel, No, US: 001-800-424-9300 / Europe: 001-703-527-3887

2. Hazard(s) Identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Corrosion/irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Target Organs - Central nervous system (CNS).</td>
<td></td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 2</td>
</tr>
<tr>
<td>Target Organs - Liver.</td>
<td></td>
</tr>
</tbody>
</table>

Label Elements

Signal Word Warning

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause drowsiness or dizziness
May cause damage to organs through prolonged or repeated exposure
Precautionary Statements
Prevention
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Do not get in eyes, on skin, or on clothing
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>129-00-0</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

4. First-aid measures
Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation
Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

Ingestion
Do not induce vomiting. Obtain medical attention.

Most important symptoms/effects
No information available.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures
Suitable Extinguishing Media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media
No information available
Flash Point: 210 °C / 410 °F  
Method: No information available

Autoignition Temperature: No information available

Explosion Limits
   Upper: No data available
   Lower: No data available

Sensitivity to Mechanical Impact: No information available

Sensitivity to Static Discharge: No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

<table>
<thead>
<tr>
<th>NFPA</th>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**6. Accidental release measures**

Personal Precautions
Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.

Environmental Precautions
Should not be released into the environment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up
Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid dust formation.

**7. Handling and storage**

Handling

Storage
Keep containers tightly closed in a dry, cool and well-ventilated place.

**8. Exposure controls / personal protection**

Exposure Guidelines
This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Engineering Measures
Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166,

Skin and body protection
Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical State</th>
<th>Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No information available</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>148 - 152 °C / 298 - 306 °F</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>393 °C / 739.4 °F @ 760 mmHg</td>
</tr>
<tr>
<td>Flash Point</td>
<td>210 °C / 410 °F</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability (solid,gas)</td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>No information available</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Relative Density</td>
<td>No information available</td>
</tr>
<tr>
<td>Solubility</td>
<td>No information available</td>
</tr>
<tr>
<td>Partition coefficient; n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>No information available</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>C16 H10</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>202.25</td>
</tr>
</tbody>
</table>

10. Stability and reactivity

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid

Incompatible Materials
Strong oxidizing agents

Hazardous Decomposition Products
Carbon monoxide (CO), Carbon dioxide (CO₂)

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
No acute toxicity information is available for this product

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral (Rat)</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>2700 mg/kg</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Irritating to eyes and skin

Sensitization
No information available
Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>129-00-0</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
Central nervous system (CNS)

STOT - repeated exposure
Liver

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
Tumorigenic effects have been reported in experimental animals. The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
</table>
| Pyrene      | Not listed       | Oncorhynchus mykiss: LC50 > 2mg/L 96h | Not listed | EC50 48h 1.8 mg/L  
|             |                  |                 |          | EC50 48h 0.002-0.003 mg/L |

Persistence and Degradability
No information available

Bioaccumulation/ Accumulation
No information available.

Mobility

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>4.88</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

<table>
<thead>
<tr>
<th>UN-No</th>
<th>Proper Shipping Name</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN3077</td>
<td>Environmentally hazardous substance, solid, n.o.s</td>
<td>9</td>
<td>III</td>
</tr>
</tbody>
</table>

TDG

<table>
<thead>
<tr>
<th>UN-No</th>
<th>Proper Shipping Name</th>
<th>Hazard Class</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN3077</td>
<td>Environmentally hazardous substance, solid, n.o.s</td>
<td>9</td>
<td>III</td>
</tr>
</tbody>
</table>

IATA
15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IESC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>204-927-3</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Legend:

X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates that a substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313 Not applicable

SARA 311/312 Hazardous Categorization

<table>
<thead>
<tr>
<th>Hazardous Categorization</th>
<th>Acute Health Hazard</th>
<th>Chronic Health Hazard</th>
<th>Fire Hazard</th>
<th>Sudden Release of Pressure Hazard</th>
<th>Reactive Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>5000 lb</td>
<td>5000 lb</td>
</tr>
</tbody>
</table>

California Proposition 65 This product does not contain any Proposition 65 chemicals
State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant: N
DOT Severe Marine Pollutant: N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
D2B Toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 01-Jul-2010
Revision Date 10-Feb-2015
Print Date 10-Feb-2015
Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
Material Safety Data Sheet
sec-Butylbenzene, 99+%  

MSDS# 73785

Section 1 - Chemical Product and Company Identification

MSDS Name: sec-Butylbenzene, 99+%  
Catalog Numbers: AC107860000, AC107860050, AC107860500, AC107861000, AC107862500, AC107865000
Synonyms: 2-Phenylbutane; Benzene, (1-methylpropyl)-; (1-Methylpropyl)benzene; Benzene, sec-butyl-

Company Identification:
Acros Organics BVBA
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium

Company Identification: (USA)
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410
For information in the US, call: 800-ACROS-01
For information in Europe, call: +32 14 57 52 11
Emergency Number, Europe: +32 14 57 52 99
Emergency Number US: 201-796-7100
CHEMTREC Phone Number, US: 800-424-9300
CHEMTREC Phone Number, Europe: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#: 135-98-8
Chemical Name: sec-Butylbenzene
%: 99+
EINECS#: 205-227-0

Hazard Symbols: XI

Risk Phrases: 10 36/37/38

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. May cause central nervous system depression. Causes eye, skin, and respiratory tract irritation. Target Organs: Central nervous system.

Potential Health Effects

Eye: Causes eye irritation.
Skin: Causes skin irritation.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Ingestion of large amounts may cause CNS depression.
Inhalation: Causes respiratory tract irritation.
Chronic: Prolonged or repeated skin contact may cause dermatitis.

Section 4 - First Aid Measures
Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Will burn if involved in a fire. Use water spray to keep fire-exposed containers cool. Containers may explode in the heat of a fire. Flammable liquid and vapor.

Extinguishing Media:
For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Use agent most appropriate to extinguish fire. Do NOT use straight streams of water.

Autoignition Temperature: 415 deg C (779.00 deg F)
Flash Point: 45 deg C (113.00 deg F)
Explosion Limits: Lower,
0.80 vol %
Explosion Limits: Upper,
6.90 vol %
NFPA Rating: health: 2; flammability: 2; instability: 0;

Section 6 - Accidental Release Measures

General Information:
Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors.

Section 7 - Handling and Storage

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:
Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area.

Section 8 - Exposure Controls, Personal Protection

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH</th>
<th>NIOSH</th>
<th>OSHA - Final PELs</th>
</tr>
</thead>
<tbody>
<tr>
<td>sec-Butylbenzene</td>
<td>none listed</td>
<td>none listed</td>
<td>none listed</td>
</tr>
</tbody>
</table>

OSHA Vacated PELs: sec-Butylbenzene: None listed

Engineering Controls:
Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.

Exposure Limits
Personal Protective Equipment

Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Color: clear colorless
Odor: None reported.
pH: Not available
Vapor Pressure: 4 mm Hg @ 37.7 deg C
Vapor Density: 4.62
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: 173 - 174 deg C @ 760 mm Hg
Freezing/Melting Point: -75 deg C (-103.00°F)
Decomposition Temperature: Not available
Solubility in water: 0.015 g/L water
Specific Gravity/Density: 0.8630 g/cm3
Molecular Formula: C10H14
Molecular Weight: 134.22

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 135-98-8: CY9100000
RTECS:
CAS# 135-98-8: Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 100 mg/24H Moderate;
LD50/LC50:
Oral, mouse: LD50 = 8700 mg/kg;
Oral, rat: LD50 = 2240 uL/kg;
Oral, rat: LD50 = 6300 mg/kg;
Skin, rabbit: LD50 = >16 mL/kg;
Carcinogenicity: sec-Butylbenzene - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.
Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: BUTYL BENZENES
Hazard Class: 3
UN Number: UN2709
Packing Group: III
Canada TDG
Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols: XI
Risk Phrases:
   R 10 Flammable.
   R 36/37/38 Irritating to eyes, respiratory system and skin.
Safety Phrases:
   S 9 Keep container in a well-ventilated place.
   S 16 Keep away from sources of ignition - No smoking.
   S 33 Take precautionary measures against static discharges.

WGK (Water Danger/Protection)
CAS# 135-98-8: 1

Canada
CAS# 135-98-8 is listed on Canada's DSL List
Canadian WHMIS Classifications: B3, D2B
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
CAS# 135-98-8 is not listed on Canada's Ingredient Disclosure List.

US Federal
TSCA
CAS# 135-98-8 is listed on the TSCA Inventory.

Section 16 - Other Information
MSDS Creation Date: 9/02/1997
Revision #9 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

--------------------------------------------------------------------------------
1. Identification

Product Name: Selenium
Cat No.: AC419270000; AC419271000; AC419275000
Synonyms: None
Recommended Use: Laboratory chemicals.
Uses advised against: No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information US call: 001-800-ACROS-01
/ Europe call: +32 14 57 52 11
Emergency Number US:001-201-796-7100 /
Europe: +32 14 57 52 99
CHEMTREC Tel. No,US:001-800-424-9300 /
Europe:001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Label Elements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute oral toxicity</td>
<td>Category 3</td>
</tr>
<tr>
<td>Acute Inhalation Toxicity - Dusts and Mists</td>
<td>Category 3</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 2</td>
</tr>
</tbody>
</table>

Signal Word
Danger

Hazard Statements
Toxic if swallowed
Toxic if inhaled
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray

**Response**
Get medical attention/advice if you feel unwell

**Inhalation**
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician

**Ingestion**
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Rinse mouth

**Storage**
Store locked up
Store in a well-ventilated place. Keep container tightly closed

**Disposal**
Dispose of contents/container to an approved waste disposal plant

**Hazards not otherwise classified (HNOC)**
May cause long lasting harmful effects to aquatic life

---

### 3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>7782-49-2</td>
<td>&gt; 99.5</td>
</tr>
</tbody>
</table>

---

### 4. First-aid measures

**Eye Contact**
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

**Skin Contact**
Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.

**Inhalation**
Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Immediate medical attention is required.

**Ingestion**
Do not induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. Call a physician immediately. If possible drink milk afterwards.

**Most important symptoms/effects**
No information available.

**Notes to Physician**
Treat symptomatically

---

### 5. Fire-fighting measures

**Suitable Extinguishing Media**
Water spray. Carbon dioxide (CO₂). Dry chemical. chemical foam.

**Unsuitable Extinguishing Media**
No information available

**Flash Point**
No information available

**Method -**
No information available

**Autoignition Temperature**
No information available

**Explosion Limits**
Upper: No data available
Lower: No data available

**Sensitivity to Mechanical Impact**
No information available

**Sensitivity to Static Discharge**
No information available

**Specific Hazards Arising from the Chemical**
Vapors may form explosive mixtures with air.

**Hazardous Combustion Products**
None known

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

**NFPA**

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**6. Accidental release measures**

**Personal Precautions**
Ensure adequate ventilation. Use personal protective equipment.

**Environmental Precautions**
See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

**Methods for Containment and Clean Up**
Sweep up or vacuum up spillage and collect in suitable container for disposal.

**7. Handling and storage**

**Handling**
Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Use only in area provided with appropriate exhaust ventilation.

**Storage**
Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep under nitrogen.

**8. Exposure controls / personal protection**

**Exposure Guidelines**

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>TWA: 0.2 mg/m³</td>
<td>(Vacated) TWA: 0.2 mg/m³</td>
<td>IDLH: 1 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA: 0.2 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Quebec</th>
<th>Mexico OEL (TWA)</th>
<th>Ontario TWAEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>TWA: 0.2 mg/m³</td>
<td>TWA: 0.2 mg/m³</td>
<td>TWA: 0.2 mg/m³</td>
</tr>
</tbody>
</table>

**Legend**

- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration
- NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

**Engineering Measures**
Ensure that eyewash stations and safety showers are close to the workstation location.

**Personal Protective Equipment**

- **Eye/face Protection**
  Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

- **Skin and body protection**
  Wear appropriate protective gloves and clothing to prevent skin exposure.

- **Respiratory Protection**
  A NIOSH/MSHA approved air purifying dust or mist respirator or European Standard EN 149.

**Hygiene Measures**
Handle in accordance with good industrial hygiene and safety practice.

**9. Physical and chemical properties**
10. Stability and reactivity

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid
Incompatible products.

Incompatible Materials
Acids, Strong oxidizing agents, Fluorine, oxygen, Metals

Hazardous Decomposition Products
None under normal use conditions

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
No acute toxicity information is available for this product

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD50 Oral</th>
<th>LD50 Dermal</th>
<th>LC50 Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>6700 mg/kg (Rat)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
No information available

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
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</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>7782-49-2</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>
Selenium

Mutagenic Effects
No information available

Reproductive Effects
No information available.

Developmental Effects
No information available.

Teratogenicity
No information available.

STOT - single exposure
None known

STOT - repeated exposure
None known

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability
No information available

Bioaccumulation/ Accumulation
No information available.

Mobility
No information available.

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

<table>
<thead>
<tr>
<th>UN-No</th>
<th>Hazard Class</th>
<th>Packing Group</th>
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</thead>
<tbody>
<tr>
<td>UN3283</td>
<td>6.1</td>
<td>III</td>
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</tbody>
</table>

TDG

<table>
<thead>
<tr>
<th>UN-No</th>
<th>Hazard Class</th>
<th>Packing Group</th>
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<tbody>
<tr>
<td>UN3283</td>
<td>6.1</td>
<td>III</td>
</tr>
</tbody>
</table>

IATA

<table>
<thead>
<tr>
<th>UN-No</th>
<th>Proper Shipping Name</th>
<th>Hazard Class</th>
<th>Packing Group</th>
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<tbody>
<tr>
<td>3283</td>
<td>SELENIUM COMPOUND, SOLID, N.O.S.</td>
<td>6.1</td>
<td>III</td>
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</table>

IMDG/IMO

<table>
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<th>Hazard Class</th>
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<tbody>
<tr>
<td>3283</td>
<td>SELENIUM COMPOUND, SOLID, N.O.S.</td>
<td>6.1</td>
<td>III</td>
</tr>
</tbody>
</table>

15. Regulatory information

International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>231-957-4</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
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<tbody>
<tr>
<td>Selenium</td>
<td>7782-49-2</td>
<td>&gt; 99.5</td>
<td>1.0</td>
</tr>
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</table>

SARA 311/312 Hazardous Categorization

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Health Hazard</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Sudden Release of Pressure Hazard</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Reactive Hazard</td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

Clean Water Act

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clean Air Act Not applicable

<table>
<thead>
<tr>
<th>Component</th>
<th>HAPS Data</th>
<th>Class 1 Ozone Depletors</th>
<th>Class 2 Ozone Depletors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>100 lb</td>
<td>-</td>
</tr>
</tbody>
</table>

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N
U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
D1A  Very toxic materials
D2B  Toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date
10-Feb-2015

Print Date
10-Feb-2015

Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Sodium
Product Number: 483745
Brand: Aldrich
CAS-No.: 7440-23-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)
H260: In contact with water releases flammable gases which may ignite spontaneously.
H314: Causes severe skin burns and eye damage.
H318: Causes serious eye damage.
H350: May cause cancer.

Precautionary statement(s)
P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P223: Keep away from any possible contact with water, because of violent reaction and possible flash fire.
Handle under inert gas. Protect from moisture.
Do not breathe dust or mist.
Wash skin thoroughly after handling.
Wear protective gloves/protective clothing/eye protection/face protection.
Use personal protective equipment as required.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
IF exposed or concerned: Get medical advice/attention.

Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.

Wash contaminated clothing before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Store in a dry place. Store in a closed container.
Store locked up.
Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
Reacts violently with water.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures
Formula: Na
Molecular weight: 22.99 g/mol

<table>
<thead>
<tr>
<th>Hazardous components</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sodium</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS-No.</td>
<td>7440-23-5</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>231-132-9</td>
<td></td>
</tr>
<tr>
<td>Index-No.</td>
<td>011-001-00-0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water-react. 1; Skin Corr. 1B; Eye Dam. 1; H260, H314</td>
<td>&gt;= 90 - &lt;= 100 %</td>
</tr>
<tr>
<td><strong>Paraffin oils</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS-No.</td>
<td>8012-95-1</td>
<td></td>
</tr>
<tr>
<td>EC-No.</td>
<td>232-384-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carc. 1A; H350</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;= 90 - &lt;= 100 %</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.
If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Dry powder

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.
Handle and store under inert gas. Air sensitive.
Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
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</thead>
<tbody>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>STEL</td>
<td>10.000000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>5.000000 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td>10.000000 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
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<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
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<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
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<td></td>
<td>Upper Respiratory Tract irritation</td>
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<td>2014 Adoption</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>Upper Respiratory Tract irritation</td>
</tr>
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</tr>
<tr>
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<td>Exposure by all routes should be carefully controlled to levels as low as possible.</td>
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<td></td>
<td>Suspected human carcinogen</td>
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<td></td>
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</tr>
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<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Suspected human carcinogen</td>
</tr>
</tbody>
</table>

### 8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals, Flame retardant protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Appearance</td>
<td>Form: Pieces</td>
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<tr>
<td>b) Odour</td>
<td>No data available</td>
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<tr>
<td>c) Odour Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d) pH</td>
<td>No data available</td>
</tr>
<tr>
<td>e) Melting point/freezing point</td>
<td>Melting point/range: 97.8 °C (208.0 °F) - lit.</td>
</tr>
<tr>
<td>f) Initial boiling point and boiling range</td>
<td>883 °C (1,621 °F) - lit.</td>
</tr>
<tr>
<td>g) Flash point</td>
<td>82 °C (180 °F)</td>
</tr>
<tr>
<td>h) Evaporation rate</td>
<td>No data available</td>
</tr>
<tr>
<td>i) Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>j) Upper/lower flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>k) Vapour pressure</td>
<td>No data available</td>
</tr>
<tr>
<td>l) Vapour density</td>
<td>No data available</td>
</tr>
<tr>
<td>m) Relative density</td>
<td>0.97 g/cm³</td>
</tr>
</tbody>
</table>
n) Water solubility  
No data available

o) Partition coefficient: n-octanol/water  
No data available

p) Auto-ignition temperature  
No data available

q) Decomposition temperature  
No data available

r) Viscosity  
No data available

s) Explosive properties  
No data available

t) Oxidizing properties  
No data available

9.2 Other safety information  
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity  
No data available

10.2 Chemical stability  
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions  
Reacts violently with water.

10.4 Conditions to avoid  
Air  
Do not allow water to enter container.  
Exposure to moisture

10.5 Incompatible materials  
Oxidizing agents

10.6 Hazardous decomposition products  
Other decomposition products - No data available  
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity  
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation  
No data available

Serious eye damage/eye irritation  
No data available

Respiratory or skin sensitisation  
No data available

Germ cell mutagenicity  
No data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (Paraffin oils)
NTP: Known to be human carcinogen. The reference note has been added by TD based on the background information of the NTP. (Paraffin oils)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

Burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., Aspiration may lead to:, lipid pneumonia, Effects due to ingestion may include:, laxative effect, Gastrointestinal disturbance, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1428 Class: 4.3 Packing group: I
Proper shipping name: Sodium
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

**IMDG**
- UN number: 1428
- Class: 4.3
- Packing group: I
- EMS-No: F-G, S-N

**IATA**
- UN number: 1428
- Class: 4.3
- Packing group: I
- Proper shipping name: Sodium
- IATA Passenger: Not permitted for transport

### 15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard

#### Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>7440-23-5</td>
<td>1993-04-24</td>
</tr>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
<td>2007-03-01</td>
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</tbody>
</table>

#### Pennsylvania Right To Know Components

<table>
<thead>
<tr>
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<th>Revision Date</th>
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</thead>
<tbody>
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<td>2007-03-01</td>
</tr>
</tbody>
</table>

#### New Jersey Right To Know Components

<table>
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<tr>
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<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
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<tr>
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<td>8012-95-1</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

#### California Prop. 65 Components

**WARNING! This product contains a chemical known to the State of California to cause cancer.**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
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</thead>
<tbody>
<tr>
<td>Paraffin oils</td>
<td>8012-95-1</td>
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### 16. OTHER INFORMATION

**Full text of H-Statements referred to under sections 2 and 3.**

<table>
<thead>
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<th>H-Statement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Carc.</td>
<td>Carcinogenicity</td>
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<tr>
<td>Eye Dam.</td>
<td>Serious eye damage</td>
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<tr>
<td>H260</td>
<td>In contact with water releases flammable gases which may ignite spontaneously.</td>
</tr>
<tr>
<td>H314</td>
<td>Causes severe skin burns and eye damage.</td>
</tr>
<tr>
<td>H318</td>
<td>Causes serious eye damage.</td>
</tr>
<tr>
<td>H350</td>
<td>May cause cancer.</td>
</tr>
<tr>
<td>Skin Corr.</td>
<td>Skin corrosion</td>
</tr>
<tr>
<td>Water-react.</td>
<td>Substances and mixtures, which in contact with water, emit flammable gases</td>
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**HMIS Rating**

<table>
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<tr>
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<th>Value</th>
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<td>Chronic Health Hazard</td>
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<td>Flammability</td>
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<tr>
<td>Physical Hazard</td>
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</table>
NFPA Rating
Health hazard: 3
Fire Hazard: 4
Reactivity Hazard: 2
Special hazard I: W

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
Version: 4.11 Revision Date: 03/05/2015 Print Date: 02/07/2016
1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: TERT-BUTANOL

TRADE NAMES/SYNONYMS:
T-BUTANOL; 1,1-DIMETHYLETHANOL; TRIMETHYLCARBINOL; TRIMETHYMETHANOL;
TRIMETHYL METHANOL; BUTYL ALCOHOL; 2-METHYL-2-PROpanol; TERT-BUTYL
ALCOHOL; TRIMETHYL CARBINOL; UN 1120; C4H10O; 00230215; RTECS EO1925000

CHEMICAL FAMILY: aliphatic, alcohols

CREATION DATE: Dec 01 2003
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: TERT-BUTANOL
CAS NUMBER: 75-65-0
PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2  FIRE=3  REACTIVITY=0

EMERGENCY OVERVIEW:
CHANGE IN APPEARANCE: hygroscopic
COLOR: colorless
PHYSICAL FORM: crystals, liquid
ODOR: pungent odor
MAJOR HEALTH HAZARDS: respiratory tract irritation, eye irritation, central nervous system
depression
PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation, nausea, vomiting, difficulty breathing, headache, drowsiness, dizziness, loss of coordination, blurred vision
LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation

EYE CONTACT:
SHORT TERM EXPOSURE: irritation, blurred vision
LONG TERM EXPOSURE: irritation

INGESTION:
SHORT TERM EXPOSURE: nausea, vomiting, diarrhea, stomach pain, headache, drowsiness, dizziness, loss of coordination, unconsciousness
LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive.

EXTINGUISHING MEDIA: alcohol-resistant foam, carbon dioxide, regular dry chemical, water

Large fires: Use alcohol-resistant foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Dike for later disposal. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. Withdraw immediately in case of rising sound from
venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: 52 F (11 C) (CC)
LOWER FLAMMABLE LIMIT: 2.4%
UPPER FLAMMABLE LIMIT: 8.0%
AUTOIGNITION: 892 F (478 C)
FLAMMABILITY CLASS (OSHA): IB

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Remove sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

7. HANDLING AND STORAGE


8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
TERT-BUTANOL:
TERT-BUTYL ALCOHOL:
100 ppm (300 mg/m3) OSHA TWA
150 ppm (450 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)
100 ppm ACGIH TWA
100 ppm (300 mg/m3) NIOSH recommended TWA 10 hour(s)
150 ppm (450 mg/m3) NIOSH recommended STEL

VENTILATION: Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.
EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

**1600 ppm**
- Any supplied-air respirator operated in a continuous-flow mode.
- Any powered, air-purifying respirator with organic vapor cartridge(s).
- Any air-purifying respirator with a full facepiece and an organic vapor canister.
- Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
- Any self-contained breathing apparatus with a full facepiece.
- Any supplied-air respirator with a full facepiece.
- Emergency or planned entry into unknown concentrations or IDLH conditions -
  - Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
  - Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape -
- Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
- Any appropriate escape-type, self-contained breathing apparatus.

---

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**PHYSICAL STATE:** liquid
**COLOR:** colorless
**CHANGE IN APPEARANCE:** hygroscopic
**PHYSICAL FORM:** crystals, liquid
**ODOR:** pungent odor
**MOLECULAR WEIGHT:** 74.12
**MOLECULAR FORMULA:** (C-H3)3-C-O-H
**BOILING POINT:** 180 F (82 C)
**MELTING POINT:** 79 F (26 C)
**VAPOR PRESSURE:** 31 mmHg @ 20 C
**VAPOR DENSITY (air=1):** 2.6
**SPECIFIC GRAVITY (water=1):** 0.7887
**WATER SOLUBILITY:** soluble
**PH:** Not available
**VOLATILITY:** Not available
**ODOR THRESHOLD:** 73 ppm
10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: metals, acids, oxidizing materials, combustible materials, metal salts

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

TERT-BUTANOL:
IRRITATION DATA: 500 ul/24 hour(s) skin-rabbit mild; 100 ul/24 hour(s) eyes-rabbit severe
TOXICITY DATA: >10000 ppm/4 hour(s) inhalation-rat LC50; >2 gm/kg skin-rabbit LD50; 2743 mg/kg oral-rat LD50
CARCINOGEN STATUS: ACGIH: A4 - Not Classifiable as a Human Carcinogen
LOCAL EFFECTS:
Irritant: inhalation, eye
ACUTE TOXICITY LEVEL:
Moderately Toxic: ingestion
TARGET ORGANS: central nervous system
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies
TUMORÍGENIC DATA: Available.
MUTAGENIC DATA: Available.
REPRODUCTIVE EFFECTS DATA: Available.
ADDITIONAL DATA: Alcohol may enhance the toxic effects.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 6410000 ug/L 96 hour(s) LC50 (Mortality) Fathead minnow (Pimephales promelas)
INVERTEBRATE TOXICITY: 5504000 ug/L 48 hour(s) EC50 (Immobilization) Water flea (Daphnia magna)

OTHER TOXICITY: 2450000 ug/L 48 hour(s) LC50 (Mortality) Clawed toad (Xenopus laevis)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Butanols
ID NUMBER: UN1120
HAZARD CLASS OR DIVISION: 3
PACKING GROUP: II
LABELING REQUIREMENTS: 3

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Butanols
UN NUMBER: UN1120
CLASS: 3
PACKING GROUP/CATEGORY: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.


SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):
ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65): TERT-BUTYL ALCOHOL


STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

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1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: tert-Butylbenzene
Product Number: B90602
Brand: Aldrich
CAS-No.: 98-06-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 3), H226
Eye irritation (Category 2A), H319
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H226 Flammable liquid and vapour.
H319 Causes serious eye irritation.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P264 Wash skin thoroughly after handling.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391 Collect spillage.
P403 + P235 Store in a well-ventilated place. Keep cool.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms: 2-Methyl-2-phenylpropane

Formula: C_{10}H_{14}
Molecular weight: 134.22 g/mol
CAS-No.: 98-06-6
EC-No.: 202-632-4

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
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<tr>
<td>tert-Butylbenzene</td>
<td>Flam. Liq. 3; Eye Irrit. 2A;</td>
<td>&lt;= 100 %</td>
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<tr>
<td></td>
<td>Aquatic Acute 2; Aquatic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chronic 2; H226, H319, H411</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
For small (incipient) fires, use media such as “alcohol” foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.
Personal protective equipment

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

- **Full contact**
  - Material: Fluorinated rubber
  - Minimum layer thickness: 0.7 mm
  - Break through time: 480 min
  - Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

- **Splash contact**
  - Material: Fluorinated rubber
  - Minimum layer thickness: 0.7 mm
  - Break through time: 480 min
  - Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

**Body Protection**
Impervious clothing, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**9.1 Information on basic physical and chemical properties**

- **Appearance**
  - Form: liquid, clear
  - Colour: colourless

- **Odour**
  - No data available

- **Odour Threshold**
  - No data available

- **pH**
  - No data available

- **Melting point/freezing point**
  - Melting point/range: -58 °C (-72 °F) - lit.

- **Initial boiling point and boiling range**
  - 169 °C (336 °F) - lit.

- **Flash point**
  - 34.0 °C (93.2 °F) - closed cup

- **Evaporation rate**
  - No data available

- **Flammability (solid, gas)**
  - No data available

- **Upper/lower**
  - Lower explosion limit: 0.8 % (V)
flammability or explosive limits

k) Vapour pressure No data available

l) Vapour density No data available

m) Relative density 0.867 g/cm³ at 25 °C (77 °F)

n) Water solubility No data available

o) Partition coefficient: n-octanol/water log Pow: 3.80

p) Auto-ignition temperature 450.0 °C (842.0 °F)

q) Decomposition temperature No data available

r) Viscosity No data available

s) Explosive properties No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 3,045 mg/kg

Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Aldrich - B90602
Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CY9120000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC0 - Leuciscus idus (Golden orfe) - 44 mg/l - 48.0 h
LC50 - Leuciscus idus (Golden orfe) - 65 mg/l - 48.0 h
Toxicity to daphnia and other aquatic invertebrates LC50 - Daphnia magna (Water flea) - 41 mg/l - 24 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.
13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

**Product**
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging**
Dispose of as unused product.

14. TRANSPORT INFORMATION

**DOT (US)**
- UN number: 2709
- Class: 3
- Packing group: III
- Proper shipping name: Butyl benzenes
- Marine pollutant: yes
- Poison Inhalation Hazard: No

**IMDG**
- UN number: 2709
- Class: 3
- Packing group: III
- EMS-No: F-E, S-D

**IATA**
- UN number: 2709
- Class: 3
- Packing group: III
- Proper shipping name: Butylbenzenes

15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Fire Hazard, Acute Health Hazard

**Massachusetts Right To Know Components**
No components are subject to the Massachusetts Right to Know Act.

**Pennsylvania Right To Know Components**
- tert-Butylbenzene
  - CAS-No.: 98-06-6
  - Revision Date: 1993-04-24

**New Jersey Right To Know Components**
- tert-Butylbenzene
  - CAS-No.: 98-06-6
  - Revision Date: 1993-04-24

**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

**Full text of H-Statements referred to under sections 2 and 3.**
- Aquatic Acute: Acute aquatic toxicity
- Aquatic Chronic: Chronic aquatic toxicity
- Eye Irrit.: Eye irritation
- Flam. Liq.: Flammable liquids
H226 Flammable liquid and vapour.
H319 Causes serious eye irritation.
H401 Toxic to aquatic life.
H411 Toxic to aquatic life with long lasting effects.

HMIS Rating
Health hazard: 2
Chronic Health Hazard:
Flammability: 3
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a
guide. The information in this document is based on the present state of our knowledge and is applicable to the
product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the
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slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.5 Revision Date: 11/04/2015 Print Date: 02/22/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name : Tetrahydrofuran

Product Number : 401757
Brand : Sigma-Aldrich
Index-No. : 603-025-00-0

CAS-No. : 109-99-9

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet
Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Acute toxicity, Oral (Category 4), H302
Eye irritation (Category 2A), H319
Carcinogenicity (Category 2), H351
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H302 Harmful if swallowed.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H351 Suspected of causing cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and
understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting/equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. Rinse mouth.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS
May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms: THF
Formula: C₄H₈O
Molecular weight: 72.11 g/mol
CAS-No.: 109-99-9
EC-No.: 203-726-8
Index-No.: 603-025-00-0
Registration number: 01-2119444314-46-XXXX

Hazardous components

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<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
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</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>Flam. Liq. 2; Acute Tox. 4; Eye Irrit. 2A; Carc. 2; STOT SE 3; H225, H302, H319, H335, H351</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.
If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment. Keep away from sources of ignition. No smoking. Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Dry residue is explosive. Store under inert gas. Test for peroxide formation periodically and before distillation.
Storage class (TRGS 510): Flammable liquids
7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

**Components with workplace control parameters**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
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</thead>
<tbody>
<tr>
<td>Tetrahydrofuran</td>
<td>109-99-9</td>
<td>TWA</td>
<td>50.000000 ppm</td>
<td>USA, ACGIH Threshold Limit Values (TLV)</td>
</tr>
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<td></td>
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<td></td>
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<td></td>
<td>Remarks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Central Nervous System impairment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Upper Respiratory Tract irritation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kidney damage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Confirmed animal carcinogen with unknown relevance to humans</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Danger of cutaneous absorption</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>STEL</td>
<td>100.000000 ppm</td>
<td>USA, ACGIH Threshold Limit Values (TLV)</td>
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<td></td>
<td>Danger of cutaneous absorption</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
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<td>590.000000 ppm</td>
<td>USA, NIOSH Recommended Exposure Limits</td>
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<td>735.000000 ppm</td>
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<td>735.000000 ppm</td>
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<td>TWA</td>
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<td>USA, Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
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</tbody>
</table>

The value in mg/m3 is approximate.

**Biological occupational exposure limits**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
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<tr>
<td>Tetrahydrofuran</td>
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<td>Tetrahydrofuran</td>
<td>2.0000</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
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<td></td>
<td></td>
<td>End of shift</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(As soon as possible after exposure ceases)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Derived No Effect Level (DNEL)**

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Exposure routes</th>
<th>Health effect</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>25mg/kg BW/d</td>
</tr>
<tr>
<td>Consumers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>15mg/kg BW/d</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Long-term local effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>62 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Acute local effects</td>
<td>150 mg/m3</td>
</tr>
<tr>
<td>Consumers</td>
<td>Inhalation</td>
<td>Acute systemic effects</td>
<td>150 mg/m3</td>
</tr>
</tbody>
</table>
Predicted No Effect Concentration (PNEC)

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>2.13 mg/kg</td>
</tr>
<tr>
<td>Marine water</td>
<td>0.432 mg/l</td>
</tr>
<tr>
<td>Fresh water</td>
<td>4.32 mg/l</td>
</tr>
<tr>
<td>Marine sediment</td>
<td>2.33 mg/kg</td>
</tr>
<tr>
<td>Fresh water sediment</td>
<td>23.3 mg/kg</td>
</tr>
<tr>
<td>Onsite sewage treatment plant</td>
<td>4.6 mg/l</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 18 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
Form: liquid, clear
Colour: colourless
b) Odour
ether-like
c) Odour Threshold
No data available
d) pH
ca. 7
e) Melting point/freezing
Melting point/range: -108.44 °C (-163.19 °F) at 1,013.25 hPa (760.00)
9.2 Other safety information

Relative vapour density: ca.2.5 at 25 °C (77 °F) - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents, Acids

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 1,650 mg/kg
LC50 Inhalation - Rat - 6 h - 14.7 mg/l
Remarks: Material may be irritating to mucous membranes and upper respiratory tract.
LD50 Dermal - Rat - > 2,000 mg/kg
No data available

**Skin corrosion/irritation**
Based on available data, the classification criteria are not met.

**Serious eye damage/eye irritation**
Eyes - Rabbit
Result: Risk of serious damage to eyes.
(Draize Test)

**Respiratory or skin sensitisation**
Based on available data, the classification criteria are not met.

**Germ cell mutagenicity**
In vivo tests did not show mutagenic effects

Ames test
S. typhimurium
Result: negative

**Carcinogenicity**
Suspected human carcinogens

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**
No data available

No toxicity to reproduction

**Specific target organ toxicity - single exposure**
May cause drowsiness or dizziness. - Nervous system
May cause respiratory irritation.

**Specific target organ toxicity - repeated exposure**
The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

**Aspiration hazard**
No aspiration toxicity classification

**Additional Information**
RTECS: LU5950000

Central nervous system depression, Cough, chest pain, Difficulty in breathing, Exposure to high airborne concentrations can cause anesthetic effects.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

---

**12. ECOLOGICAL INFORMATION**

**12.1 Toxicity**

Toxicity to fish
LC50 - Pimephales promelas (fathead minnow) - 2,160 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates
EC50 - Daphnia magna (Water flea) - 382 mg/l - 24 h

Toxicity to algae
Growth inhibition IC50 - Algae - 3,700 mg/l - 192 h
12.2 Persistence and degradability
Biodegradability

(OECD Test Guideline 301)
Remarks: According to the results of tests of biodegradability this product is not readily biodegradable.

12.3 Bioaccumulative potential
No bioaccumulation is to be expected (log Pow <= 4).

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2056   Class: 3   Packing group: II
Proper shipping name: Tetrahydrofuran
Reportable Quantity (RQ): 1000 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 2056   Class: 3   Packing group: II
Proper shipping name: TETRAHYDROFURAN
EMS-No: F-E, S-D

IATA
UN number: 2056   Class: 3   Packing group: II
Proper shipping name: Tetrahydrofuran

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran 109-99-9</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahydrofuran 109-99-9</td>
<td>1993-04-24</td>
</tr>
</tbody>
</table>
New Jersey Right To Know Components

Tetrahydrofuran

CAS-No. 109-99-9
Revision Date 1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- Acute Tox. Acute toxicity
- Carc. Carcinogenicity
- Eye Irrit. Eye irritation
- Flam. Liq. Flammable liquids
- H225 Highly flammable liquid and vapour.
- H302 Harmful if swallowed.
- H319 Causes serious eye irritation.
- H335 May cause respiratory irritation.
- H351 Suspected of causing cancer.
- STOT SE Specific target organ toxicity - single exposure

HMIS Rating
Health hazard: 1
Chronic Health Hazard: *
Flammability: 3
Physical Hazard 0

NFPA Rating
Health hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0

Further information
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Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
Version: 4.11 Revision Date: 10/29/2015 Print Date: 03/03/2016
SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Thallium Solid
Formula: TI

Supplier: ESPI Metals
1050 Benson Way
Ashland, OR 97520

Telephone: 800-638-2581
Fax: 541-488-8313
Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION


GHS Label Elements:

Signal Word: Danger

Hazard Statements: H300 Fatal if swallowed.

Precautionary Statements: P264 Wash hands thoroughly after handling, P270 Do not eat, drink or smoke when using this product, P301+P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician, P330 Rinse mouth, P405 Store locked up, P501 Dispose of contents/container in accordance with local, state or federal regulations.
3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Thallium
CAS#: 7440-28-0
%: 100
EC#: 231-138-1

4 FIRST AID MEASURES

General Measures: Emergency responders should take care to avoid secondary exposure to thallium if it is present. Wear appropriate protective equipment.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention. If mouth-to-mouth is necessary always use a barrier or bag-valve-mask device.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, wash affected area with soap and water taking care not to break the skin and to cover all open wounds. Seek medical attention. Contaminated clothing should be safely contained and properly disposed of.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention immediately.

Most Important Symptoms/Effects, Acute and Delayed: Symptoms are usually delayed and include gastrointestinal distress and neurological symptoms. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing media suitable for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No further information available.

Specific Hazards Arising from the Material: Under fire conditions, thallium may release highly toxic fumes or gases.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.
Methods and Materials for Containment and Cleaning Up: Scoop up or vacuum with a system utilizing a HEPA filtration system and place in properly labeled sealed containers. Special precautions must be taken when changing filters on HEPA vacuum cleaners used to clean up hazardous materials. Avoid creating dusts. Avoid contamination of air and water.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 _HANDLING AND STORAGE_

Precautions for Safe Handling: Wear appropriate respiratory and protective equipment specified in section 8. Only trained personnel should work with this product. Handle in a well-ventilated area. Avoid exposure to high temperature. Avoid breathing fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking.

Conditions for Safe Storage, Including Any Incompatibilities: Store under dry, inert gas such as argon, or can also be stored under deaerated water. Store in sealed unbreakable containers; the original labeled shipping container when possible. Store in an area that is cool, dry and temperature-controlled, away from direct sunlight, heat and ignition sources or where freezing is possible. Do not store together with acids, halogens or oxidizers. See section 10 for more information on incompatible materials.

8 _EXPOSURE CONTROLS AND PERSONAL PROTECTION_

Exposure Limits: Thallium (Soluble compounds, as TI)

OSHA/PEL: 0.1 mg/m³

ACGIH/TLV: 0.02 mg/m³ (inhalable)

Appropriate Engineering Controls: Handle in an enclosed, controlled process under dry argon. Whenever possible the use of local exhaust ventilation, process enclosure or other engineering controls is the preferred method of controlling exposure to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Clothing worn in areas of exposure to thallium dust or vapor should be restricted to the workplace and stored in special lockers.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Splash goggles or safety glasses.

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 _PHYSICAL AND CHEMICAL PROPERTIES_

Appearance:

Form: Rod

Color: Gray metallic

Odor: Odorless
Odor Threshold: Not determined

pH: N/A

Melting Point: 303.5 °C

Boiling Point: 1457±10 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 825 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 11.85 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10  STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic thallium oxide fumes.

Conditions to Avoid: Avoid high temperatures, reacts slowly with moist air.

Incompatible Materials: Oxidizing agents, strong acids, halogens, air and moisture.

Hazardous Decomposition Products: Thallium oxide fume.

11  TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: Abdominal pain and vomiting, extreme pain in the extremities, lethargy, hair loss.

Acute and Chronic Effects: Almost all of the available information refers to ingestion of thallium compounds, largely due to accidental ingestion, intentional poisoning and suicide attempts. Adverse reactions are dose dependent and occur in 3 stages. Massive doses may cause gastrointestinal distress (nausea, vomiting and abdominal pain) within 30 minutes but symptoms are usually delayed for 8 hours or longer. Gastrointestinal symptoms from smaller doses may
be delayed 24-48 hours. This is followed by neurological effects 2-5 days or even longer after ingestion, although it may occur as early as 12 hours after massive exposure. Other effects include hair loss, severe pain in the extremities, lethargy, ataxia, back pain, abnormal reflexes, neuropathy, muscle weakness, mental abnormalities, tremors, abnormal vision, headache, coma, convulsion, and death. There was no information available for exposure to thallium metal specifically rather than thallium compounds, and little conclusive information regarding exposure via inhalation.

**Acute Toxicity:** No data

**Carcinogenicity:** NTP: Not identified as carcinogenic  IARC: Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

### 12 ECOLOGICAL INFORMATION

**Ecotoxicity:** LC50 - Cyprinodon variegatus (sheepshead minnow) - 21.0 mg/l - 96.0 h

**Persistence and Degradability:** No data

**Bioaccumulative Potential:** No data

**Mobility in Soil:** No data

**Other Adverse Effects:** Do not allow material to be released to the environment. No further relevant information available.

### 13 DISPOSAL CONSIDERATIONS

**Waste Disposal Method:**

**Product:** Dispose of in accordance with Federal, State and Local regulations.

**Packaging:** Dispose of in accordance with Federal, State and Local regulations.

### 14 TRANSPORT INFORMATION

**UN Number:** UN3288

**UN Proper Shipping Name:** Toxic solid, inorganic, n.o.s. (Thallium)

**Transport Hazard Class:** 6.1

**Packing Group:** II

**Marine Pollutant:** Yes

### 15 REGULATORY INFORMATION

**TSCA Listed:** All components are listed.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity.

HMIS Ratings: Health: 3  Flammability: 0  Physical: 0

NFPA Ratings: Health: 3  Flammability: 0  Instability: 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015
Safety Data Sheets (SDS)

SECTION 1-IDENTIFICATION

Product name: Toluene

Other names:-

Proper shipping name: Toluene

Recommended use of the chemical and restrictions on use:
The major use of toluene is as a mixture added to gasoline to improve octane ratings. Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners. Used in the manufacture of chemicals, dyes, explosives, benzoic acid. Some grades of toluene may contain traces of xylene and benzene. The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

WARNING: Intentional misuse by concentrating/inhaling contents may be lethal.

Manufacturer/Supplier Name: Taiwan SM Corp., Kaohsiung plant
Address: NO.7, Industrial 1st Rd, Lin-Yuan Kaohsiung County 83203, Taiwan, R.O.C.
Phone No.: 886-7-6414511
Emergency phone No./Fax No.: 886-7-6414511 Ext. 221 (on duty), 886-7-6414517 (off duty)/886-7-6423828

SECTION 2-HAZARDS IDENTIFICATION

GHS Classification:
- Flammable Liquid Category 2
- Acute Toxicity (Oral) Category 4
- Skin Corrosion/ Irritation Category 2
- Serious Eye Damage/ Eye Irritation Category 2
- Specific Target Organ Toxicity Repeated Exposure Category 2
- Hazardous To The Aquatic Environment (Acute) Category 3
- Aspiration Hazard Category 1

GHS Label elements:

Hazard symbols

Signal word

Danger

Hazard statements

Highly flammable liquid and vapor
Harmful if inhaled
Causes skin irritation
Causes serious eye irritation
May cause damage to organs through prolonged or repeated exposure.
May cause long lasting harmful effects to aquatic life.
May be fatal if swallowed and enters airways.

Precautionary statements

Use only in well ventilated area.
Control of exposure by mechanical ventilation in an unventilated or confined space.
Avoid breathing vapors and contact with skin and eyes.
Wear breathing apparatus/protective gloves/face protection.
Store in well-ventilated place.
Disposal must be in accordance with applicable federal, state, or local regulations.

Other hazards: —

SECTION 3-COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Chemical Name</th>
<th>wt% by weight</th>
<th>EINECS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>00108-88-3</td>
<td>Toluene</td>
<td>97.0 min.</td>
<td>203-625-9</td>
</tr>
</tbody>
</table>

Synonyms: Methylbenzol; Methylbenzene; Toluol; Phenylmethane
SECTION 4-FIRST AID MEASURES

**Description of necessary first aid measures**

**Eye:**
1. Flush immediately with warm water for at least 20 minutes.
2. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
3. If pain persists or recurs seek medical attention.
4. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin:**
1. Removing contaminated clothing, shoes, and leathery wearings, cleaning procedure is available before reused or waste treatment.
2. Washing affected area thoroughly with soap and water for at least 20 minutes.
3. Call a Physician if irritation develops or persists.

**Ingestion:**
1. If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomits.
2. If victim is conscious and alert, give 2~4 cupfuls of milk/water to dilute the substance in stomach.
3. Never give anything by mouth to an unconscious person.
4. Don’t induce vomiting unless directed to do so by medical person.
5. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
6. Then seek for medical attention.

**Inhalation:**
1. Remove from further exposure and flush thoroughly with air.
2. Lay patient down. Keep warm and rested.
3. Protective such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
4. If respiratory irritation, seek immediate medical assistance and call a physician.

**Most important symptoms/effects, acute and delayed**
Headache, fatigue, drowsiness, insomnia, anorexia and pain in limbs, nervousness, impairment of memory.

**Indication of immediate medical attention and special treatment needed, if necessary**
For acute or short term repeated exposures to toluene:

**Inhalation:**
1. Inhalation overexposure can produce toxic effects. Monitor for respiratory distress.
2. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.
3. This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material.
4. Administration of sympathomimetic drugs should be avoided.

**Ingestion:**
1. If ingested, this material presents a significant aspiration and chemical pneumonitis hazard.
2. Induction of emesis is not recommended.
3. Consider activated charcoal and/or gastric lavage.
4. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5-FIRE FIGHTING MEASURES

**Extinguishing media**
Foam ・ CO₂ ・ Dry chemical ・ Water fog.

**Specific hazards arising from the chemical**
1. Liquid and vapor are highly flammable.
2. Severe fire hazard when exposed to heat, flame and/or oxidizers.
3. Vapor may travel a considerable distance to source of ignition.
4. Heating may cause expansion or decomposition leading to violent rupture of containers.
5. On combustion, may emit toxic fumes of carbon monoxide (CO).
**Special protective equipment and precautions for fire-fighters**

1. Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.
2. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles.
3. Cover pooling liquid with foam.
4. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out.
5. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.
6. Be aware that burning liquid will float on water.
7. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.

**SECTION 6-ACCIDENTAL RELEASE MEASURES**

**Personal precautions, protective equipment and emergency procedure**

1. Personal protective equipment (specified in Section 8)
   - Eyes: Chemical safety goggles are recommended, and a face shield is added when needed.
   - Skin: Wear appropriate protective gloves to avoid skin contact.
   - Clothing: When direct contact is likely, use rubberized clothings, apron and boots.
   - Respiratory: When limits are exceeded, wear a respirator approved by NIOSH/MSHA for protection against organic dust, mists and vapors.
2. Remove all sources of ignition. No smoking, naked lights or ignition sources. Ventilate area of leak or spill.

**Environmental precautions**

1. Prevent spillage from entering drains, surface, and groundwater.
2. Contain and recover liquid when possible. Use non-sparking tools and equipment.
3. Collect liquid in an appropriate container or absorb with an inert material (e.g. vermiculite, dry sand, earth), and place in a chemical waste container.
4. Report the accidental spill/release to Local/State government.

**Methods and materials for containment and cleaning up**

**Minor spill:**
1. Remove all ignition sources.
2. Clean up all spills immediately.
3. Avoid breathing vapors and contact with skin and eyes.
4. Control personal contact by using protective equipment.
5. Contain and absorb small quantities with vermiculite or other absorbent material.
6. Wipe up.
7. Collect residues in a flammable waste container.

**Major spill**
1. Clear area of personnel and move upwind.
2. Alert emergency responders and tell them location and nature of hazard.
3. May be violently or explosively reactive.
4. Wear breathing apparatus plus protective gloves.
5. Prevent spillage from entering drains or water course.
6. No smoking, naked lights or ignition sources. Increase ventilation.
7. Stop leak if safe to do so.
8. Water spray or fog may be used to disperse/absorb vapor.
9. Contain spill with sand, earth or vermiculite.
10. Use only spark-free shovels and explosion proof equipment.
11. Collect recoverable product into labeled containers for recycling.
12. Absorb remaining product with sand, earth or vermiculite.
13. Collect solid residues and seal in labeled drums for disposal.
14. Wash area and prevent runoff into drains.
15. If contamination of drains or waterways occurs, advise emergency services.

**SECTION 7-HANDLING AND STORAGE**

**Precautions for safe handling**
1. Wash thoroughly after handling.
2. Use only in well ventilated area.
3. Ground and bond containers when transferring.
4. Use spark-free tools and explosion proof equipment.
5. Empty containers retain product residue (liquid/vapor), and can be dangerous.
6. Do not pressurize, cut, weld, braze, solder, drill, or expose empty containers to heat, sparks or open flames.
**Conditions for safe storage, including any incompatibilities**

1. Store in original containers in approved flame-proof area.
2. No smoking, naked lights, heat or ignition sources.
3. DO NOT store in pits, depressions, basements or areas where vapors may be trapped.
4. Keep containers securely sealed.
5. Store away from incompatible materials in a cool, dry well ventilated area.
6. Protect containers against physical damage and check regularly for leaks.
7. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles.
8. Ground all equipment containing this material.
9. Observe manufacturer's storing and handling recommendations.
10. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C).

**SECTION 8-EXPOSURE CONTROLS, PERSONAL PROTECTION**

**OSHA - Final PELs**: 200 ppm TWA.
**OSHA Ceiling**: 300ppm.
**ACGIH**: 50 ppm, skin -potential forcutaneous absorption.
**NIOSH**: 100 ppm TWA; 375 mg/m³ TWA; 500 ppm IDLH.
**Taiwan TWA**: 100 ppm (skin).
**Taiwan STEL**: 125 ppm (skin).
**Taiwan Ceiling**: -------.
**Taiwan BEI**: 1 mg/l (before on duty).

**Engineering control**

1. Process should be located at least 17 meter (50 feet) away from open flames and all high temperature operations likely to cause ignition of the styrene monomer vapor.
2. In venting styrene monomer vapors, consideration should be given to possible halogenation of the vapors by low concentrations of free chlorine and bromine with the resultant formation of lacrimations.
3. Process should be designed so that the operator is not exposed to direct contact with Toluene or the vapor. The technical problems of designing equipment, providing adequate ventilation and operating procedures which promise maximum security and economy, can best be handled by competent engineers.
4. It is essential for safety that equipment be used and maintained as recommended by the manufacturer.
5. Tanks used to store or process Toluene should be closed vessels vented to a safe point of discharge in the outside atmosphere away from operating stations, roadways, and at least 17 meter (50 feet) from possible sources of ignitions. All sparks, flames, heated surface, or other sources of ignition should be kept away from all vents. It is advisable, to provide suction on vessels when inspection or observation openings are made, to minimize or eliminate escape of vapors.

**Personal protective equipment**

**Eye Protection**: Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

**Skin protection**: Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Clothing**: Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

**Respirators**: For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134). For airborne vapor concentrations that exceed the recommended protection factors for organic vapor respirators, use a full-face, positive-pressure, supplied air respirator. Due to fire and explosion hazards, do not enter atmospheres containing concentrations greater than 10% of the lower flammable limit of this product.
SECTIONS 9-PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Transparent liquid
Upper/lower explosive limits: 1.2%~7.1%
Odour: pleasant aromatic petroleum odour
Vapor Pressure: 22 mmHg @20°C/68 F
Odour threshold: 0.16~37 ppm (detect) 1.9~69 ppm (recognition)
Vapor Density: 3.1 (air=1)
PH: Not available
Relative density: 0.86 (water=1)
Melting/Freezing Point: −95 °C
Solubility in water: 54~58 mg/100 ml
Initial boiling point/boiling range: 110.6 °C
Partition coefficient: 2.73 (n-octanol/water)
Flash point: 4.4 °C (closed cup)
Auto-ignition temperature: 480 °C
Evaporation Rate: 2.24 (BuAc=1)
Decomposition temperature: Not available
Flammability (solid/gas): Not available
Viscosity: 0.6 mPa.s max @20°C
Molecular Formula: C₆H₅CH₃
Molecular Weight: 92.056

SECTION 10-STABILITY AND REACTIVITY

Reactivity
Vapor is explosive when exposed to heat or flame
Chemical stability
Stable at room temperature in closed containers under normal storage and handling conditions.
Possibility of hazardous reaction
Has not been reported.
Condition to avoid
Product is highly flammable – Keep away from sources of ignition. Avoid the higher temperatures. Keep away from open fire, heating elements and heat radiating surface and prevent from forming of the vapours mixtures with air in explosion limits.
Incompatible materials
Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetraoxide; will attack some forms of plastics, rubber, coatings.
Hazardous decomposition products
Carbon monoxide, carbon dioxide, hydrocarbons.

SECTION 11-TOXICOLOGICAL INFORMATION

Routes of exposure
Eye, Skin, inhalation, Ingestion.

Symptoms (treatments as indicated in Section 4)
Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated. There is evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Severe inflammation may be expected with pain. There may be damage to the cornea. Unless treatment is prompt and adequate there may be permanent loss of vision. Conjunctivitis can occur following repeated exposure.
Skin: Contact with the material may damage the health of the individual; systemic effects may result following absorption. The material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterized by redness, swelling and blistering. Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Ingestion: Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733). Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.
Inhalation: Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. There is some evidence to suggest that the material may cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo. Inhalation of high concentrations of gas/vapour causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.
Chronic exposure: There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

Toxicity
LD50: <870 mg/kg (rat, oral)
LC50: 6000 ppm/6h (rat, inhalation)

Chronic effect
Carcinogenicity:
ACGIH : A4-Not classifiable as a Human Carcinogen.
OSHA : Possible select carcinogen.
IARC : Group 3 carcinogen.

Epide miology: Not available.

Teratogenicity: Teratogenic effects have occurred in experimental animals.

Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.

Neurotoxicity: Not available.

Mutagenicity: Not available.

SECTION 12-ECOLOGICAL INFORMATION

Ecotoxicity
LC50 (96 hr.) Fish: 7.3~22.8 mg/l
EC50 (48 hr.) Water flea: —
Bioconcentration factor (BCF): 1.67~380

Persistence and degradability
1. The material are expected to form a slick on the surface of waters after release in calm sea conditions. This is expected to evaporate and enter the atmosphere where it will be degraded through reaction with hydroxyl radicals.
2. Some of the material will become associated with benthic sediments, and it is likely to be spread over a fairly wide area of sea floor. Marine sediments may be either aerobic or anaerobic. The material, in probability, is biodegradable, under aerobic conditions. Evidence also suggests that the hydrocarbons may be degradable under anaerobic conditions although such degradation in benthic sediments may be a relatively slow process.
3. Under aerobic conditions the material will degrade to water and carbon dioxide, while under aerobic processes it will produce water, methane, carbon dioxide and carbon dioxide.
4. Based on test results, as well as theoretical considerations, the potential for bioaccumulation may be high. Toxic effects are often observed in species such as blue mussel, daphnia, freshwater green algae, marine copepods and amphipods.

Half-life (Air): 10~104 hr
Half-life (Surface water): 96~528 hr
Half-life (Ground water): 168~672 hr
Half-life (Soil): 96~528 hr

Bioaccumulative potential
This material is not expected to significantly bioaccumulate.

Mobility in soil: —

Other adverse effects: —

SECTION 13-DISPOSAL CONSIDERATIONS

Residues and spilled material are hazardous waste due to ignitability. Disposal must be in accordance with applicable federal, state, or local regulations.
The container for this product can present explosion or fire hazards, even when emptied. To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.
### SECTION 14-TRANSPORTATION INFORMATION

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<th>Hazard Labels</th>
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<td>II</td>
<td>Subsidiary Class</td>
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### SECTION 15-REGULATORY INFORMATION

#### US FEDERAL

**TSCA**
- CAS# 108-88-3 is listed on the TSCA inventory.
- Health & Safety Reporting List
  - CAS# 108-88-3: Effective Date: 10/4/82; Sunset Date: 10/4/92
- Chemical Test Rules
  - None of the chemicals in this product are under a Chemical Test Rule.
- Section 12b
  - None of the chemicals are listed under TSCA Section 12b.
- TSCA Significant New Use Rule
  - None of the chemicals in this material have a SNUR under TSCA.

**SARA**
- Section 302 (RQ)
  - CAS# 108-88-3: final RQ = 1000 pounds (454 kg)
- Section 302 (TPQ)
  - None of the chemicals in this material have a TPQ.
- SARA Codes
- Section 313
  - This material contains Toluene (CAS# 108-88-3, 99% & 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

**Clean Air Act**
- CAS# 108-88-3 is listed as a hazardous air pollutant (HAP).
- This material does not contain any Class 1 Ozone depleters.
- This material does not contain any Class 2 Ozone depleters.
Clean Water Act
CAS# 108-88-3 is listed as a Hazardous Substance under the CWA.
CAS# 108-88-3 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 108-88-3 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE
Toluene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
WARNING: This product contains Toluene, a chemical known to the state of California to cause birth defects or other reproductive harm.
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: XN F
Risk Phrases: R 10 Flammable.
   R 20 Harmful by inhalation.
Safety Phrases: S 9 Keep container in a well-ventilated place.
   S 16 Keep away from sources of ignition - No smoking.
   S 25 Avoid contact with eyes.
   S 29 Do not empty into drains.
   S 33 Take precautionary measures against static discharges.

WGK (Water Danger/Protection)
CAS# 108-88-3: 2

United Kingdom Occupational Exposure Limits
CAS# 108-88-3: OES-United Kingdom, TWA 50 ppm TWA; 191 mg/m3 TWA.
CAS# 108-88-3: OES-United Kingdom, STEL 150 ppm STEL; 574 mg/m3 STEL.

CANADA
CAS#100-42-5 is listed on Canada’s DSL/NDSL list.
This product has a WHMIS classification of B2, D2A (99%)/B3, D2A (100%).
CAS# 105-05-5 is not listed on Canada’s Ingredient Disclosure List.

Exposure Limits
- CAS# 108-88-3: OEL-AUSTRALIA:TWA 100 ppm (375 mg/m3); STEL 150 ppm (560 mg/m3)
- OEL-BELGIUM:TWA 100 ppm (377 mg/m3); STEL 150 ppm (565 mg/m3)
- OEL-CZECHOSLOVAKIA:TWA 200 mg/m3; STEL 1000 mg/m3
- OEL-DENMARK:TWA 50 ppm (190 mg/m3); Skin
- OEL-FINLAND:TWA 100 ppm (375 mg/m3); STEL 150 ppm; Skin
- OEL-FRANCE:TWA 100 ppm (375 mg/m3); STEL 150 ppm (560 mg/m3)
- OEL-GERMANY:TWA 100 ppm (380 mg/m3)
- OEL-HUNGARY:TWA 100 mg/m3; STEL 300 mg/m3; Skin
- OEL-JAPAN:TWA 100 ppm (380 mg/m3)
- OEL-THE NETHERLANDS:TWA 100 ppm (375 mg/m3); Skin
- OEL-THE PHILIPPINES:TWA 100 ppm (375 mg/m3)
- OEL-POLAND:TWA 100 mg/m3
- OEL-RUSSIA:TWA 100 ppm; STEL 50 mg/m3
- OEL-SWEDEN:TWA 50 ppm (200 mg/m3); STEL 100 ppm (400 mg/m3); Skin
- OEL-SWITZERLAND:TWA 100 ppm (380 mg/m3); STEL 500 ppm
- OEL-THAILAND:TWA 200 ppm; STEL 300 ppm
- OEL-TURKEY:TWA 200 ppm (750 mg/m3)
- OEL-UNITED KINGDOM:TWA 100 ppm (375 mg/m3); STEL 150 ppm; Skin
- OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
- OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGIH TLV
SECTION 16-OTHER INFORMATION

References and sources
1. CHEMINFO Data Bank, CCINFO CD, 2005-3
2. HAZARD TEXT Data Bank, TOMES PLUS CD, Vol.65, 2005
3. RETECS Data Bank, TOMES CPS CD, Vol.65, 2005
4. HSDB Data Bank, TOMES CPS CD, Vol.65, 2005
5. Hazardous Substance Data Bank, Environment Protection, Administration, Executive Yuan, ROC (Taiwan)
6. Chemwatch Data Bank, 2005-1
7. SDS, GHS in Taiwan, Council of Labor Affairs, Executive Yuan, ROC (Taiwan)

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<th>Date</th>
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<td>Version 2</td>
<td>04/20/2001</td>
<td>Updated 10 sections to 16 sections.</td>
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<tr>
<td>Version 3</td>
<td>08/01/2003</td>
<td>Updated “SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES”.</td>
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<tr>
<td>Version 4</td>
<td>01/01/2006</td>
<td>Updated “SECTION 14-TRANSPORTATION INFORMATION”.</td>
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<td>Version 5</td>
<td>08/05/2008</td>
<td>Updated each section by GHS SDS.</td>
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Prepared by Safety & Environment Protection Section, Taiwan SM Corporation Kaohsiung Plant.
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers
Product name: trans-Chlordane
Product Number: PS752
Brand: Supelco
CAS-No.: 5103-74-2

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet
Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number
Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Signal word: Warning

Hazard statement(s)
H302 Harmful if swallowed.
H351 Suspected of causing cancer.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.
P301 + P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P330 Rinse mouth.
P391 Collect spillage.
P405 Store locked up.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Molecular weight : 409.76 g/mol
CAS-No. : 5103-74-2
EC-No. : 225-826-0

Hazardous components

<table>
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<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
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<td>trans-Chlordane</td>
<td>Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H410</td>
<td>90 - 100 %</td>
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For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available
6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: crystalline
   Colour: white

b) Odour
   odourless

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   No data available

f) Initial boiling point and boiling range
   No data available

g) Flash point
   No data available

h) Evaporation rate
   No data available

i) Flammability (solid, gas)
   No data available

j) Upper/lower flammability or explosive limits
   No data available

k) Vapour pressure
   No data available

l) Vapour density
   No data available

m) Relative density
   1.590 g/cm3

n) Water solubility
   insoluble

o) Partition coefficient: n-octanol/water
   No data available

p) Auto-ignition temperature
   No data available

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   No data available

9.2 Other safety information
   No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   No data available

10.4 Conditions to avoid
   No data available

10.5 Incompatible materials
   Strong oxidizing agents

10.6 Hazardous decomposition products
   Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Mouse - 275 mg/kg
LD50 Oral - Rat - 1,100 mg/kg
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (trans-Chlordane)
ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - Lepomis macrochirus - 0.05 mg/l - 96 h

12.2 Persistence and degradability
No data available
12.3 **Bioaccumulative potential**
No data available

12.4 **Mobility in soil**
No data available

12.5 **Results of PBT and vPvB assessment**
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 **Other adverse effects**
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

### 13. DISPOSAL CONSIDERATIONS

13.1 **Waste treatment methods**

**Product**
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

**Contaminated packaging**
Dispose of as unused product.

### 14. TRANSPORT INFORMATION

**DOT (US)**
- UN number: 3077
- Class: 9
- Packing group: III
- Reportable Quantity (RQ):
- Marine pollutant: No
- Poison Inhalation Hazard: No

**IMDG**
- UN number: 3077
- Class: 9
- Packing group: III
- EMS-No: F-A, S-F
- Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (trans-Chlordane)
- Marine pollutant: Marine pollutant

**IATA**
- UN number: 3077
- Class: 9
- Packing group: III
- Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (trans-Chlordane)

### 15. REGULATORY INFORMATION

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

**SARA 311/312 Hazards**
Acute Health Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**
No components are subject to the Massachusetts Right to Know Act.

**Pennsylvania Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>trans-Chlordane</td>
<td>5103-74-2</td>
<td></td>
</tr>
</tbody>
</table>

**New Jersey Right To Know Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>trans-Chlordane</td>
<td>5103-74-2</td>
<td></td>
</tr>
</tbody>
</table>

**California Prop. 65 Components**
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

- Acute Tox. Acute toxicity
- Aquatic Acute Acute aquatic toxicity
- Aquatic Chronic Chronic aquatic toxicity
- Carc. Carcinogenicity
- H302 Harmful if swallowed.
- H351 Suspected of causing cancer.
- H400 Very toxic to aquatic life.
- H410 Very toxic to aquatic life with long lasting effects.

**HMIS Rating**

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard:</td>
<td>1</td>
</tr>
<tr>
<td>Chronic Health Hazard:</td>
<td>*</td>
</tr>
<tr>
<td>Flammability:</td>
<td>0</td>
</tr>
<tr>
<td>Physical Hazard:</td>
<td>0</td>
</tr>
</tbody>
</table>

**NFPA Rating**

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard:</td>
<td>2</td>
</tr>
<tr>
<td>Fire Hazard:</td>
<td>0</td>
</tr>
<tr>
<td>Reactivity Hazard:</td>
<td>0</td>
</tr>
</tbody>
</table>

**Further information**

Copyright 2014 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

**Preparation Information**

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 08/14/2014 Print Date: 04/13/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: Trichlorofluoromethane
Product Number: 254991
Brand: Aldrich
CAS-No.: 75-69-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA
Telephone: +1 800-325-5832
Fax: +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #: (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Dermal (Category 4), H312

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Warning
Hazard statement(s)
H312 Harmful in contact with skin.
Precautionary statement(s)
P280 Wear protective gloves/ protective clothing.
P302 + P352 + P312 IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/ physician if you feel unwell.
P363 Wash contaminated clothing before reuse.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms: Fluorotrichloromethane
CFC-11
Formula : CCl\(_3\)F CCl\(_3\)F  
Molecular weight : 137.37 g/mol  
CAS-No. : 75-69-4  
EC-No. : 200-892-3  

### Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichlorofluoromethane</td>
<td>Acute Tox. 4; H312</td>
<td>&lt;= 100%</td>
</tr>
</tbody>
</table>

For the full text of the H-statements mentioned in this section, see Section 16.

### 4. FIRST AID MEASURES

#### 4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**
Flush eyes with water as a precaution.

**If swallowed**
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

#### 4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

#### 4.3 Indication of any immediate medical attention and special treatment needed

No data available

### 5. FIREFIGHTING MEASURES

#### 5.1 Extinguishing media

**Suitable extinguishing media**
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

#### 5.2 Special hazards arising from the substance or mixture

Carbon oxides, Hydrogen chloride gas, Hydrogen fluoride

#### 5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

#### 5.4 Further information

No data available

### 6. ACCIDENTAL RELEASE MEASURES

#### 6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. For personal protection see section 8.

#### 6.2 Environmental precautions

Do not let product enter drains.

#### 6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

#### 6.4 Reference to other sections

For disposal see section 13.
7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Recommended storage temperature 2 - 8 °C
Contents under pressure.
Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichlorofluoromethane</td>
<td>75-69-4</td>
<td>C</td>
<td>1,000.000000 ppm</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

Remarks
Cardiac sensitization
Not classifiable as a human carcinogen

|                      |       | C     | 1,000.000000 ppm 5,600.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |

|                      | TWA   | 1,000.000000 ppm 5,600.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |

The value in mg/m3 is approximate.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 30 min
Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)
data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Do not let product enter drains.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- **a)** Appearance
  - Form: liquid, clear
  - Colour: colourless

- **b)** Odour
  - No data available

- **c)** Odour Threshold
  - No data available

- **d)** pH
  - No data available

- **e)** Melting point/freezing point
  - -110.99 - -109.99 °C (-167.78 - -165.98 °F)

- **f)** Initial boiling point and boiling range
  - 23.7 °C (74.7 °F) - lit.

- **g)** Flash point
  - No data available

- **h)** Evaporation rate
  - No data available

- **i)** Flammability (solid, gas)
  - No data available

- **j)** Upper/lower flammability or explosive limits
  - No data available

- **k)** Vapour pressure
  - 885.7 hPa (664.3 mmHg) at 20.0 °C (68.0 °F)
  - 2,701.2 hPa (2,026.1 mmHg) at 55.0 °C (131.0 °F)

- **l)** Vapour density
  - No data available

- **m)** Relative density
  - 1.494 g/cm3 at 25 °C (77 °F)

- **n)** Water solubility
  - 1 g/l

- **o)** Partition coefficient: n-octanol/water
  - log Pow: 2.53

- **p)** Auto-ignition temperature
  - No data available

- **q)** Decomposition temperature
  - No data available

- **r)** Viscosity
  - No data available

- **s)** Explosive properties
  - No data available
9.2 Other safety information

Surface tension 18.0 mN/m at 25.0 °C (77.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Sodium/sodium oxides, Potassium, Magnesium, Aluminum, Zinc

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - > 15,000 mg/kg
LC50 Inhalation - Rat - 0.3 h - 130000 ppm
Remarks: Behavioral: Tremor. Behavioral: Convulsions or effect on seizure threshold. Respiratory disorder
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available
Aspiration hazard
No data available

Additional Information
RTECS: PB6125000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Nausea, Dizziness, Headache, Vomiting, Diarrhoea, Abdominal pain, Weakness, Unconsciousness
Liver -

12. ECOLOGICAL INFORMATION
12.1 Toxicity
No data available
12.2 Persistence and degradability
No data available
12.3 Bioaccumulative potential
No data available
12.4 Mobility in soil
No data available
12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted
12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS
13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION
DOT (US)
UN number: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Trichlorofluoromethane)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION
SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-69-4</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Acute toxicity
H312 Harmful in contact with skin.

HMIS Rating
Health hazard: 1
Chronic Health Hazard: 0
Flammability: 0
Physical Hazard: 0

NFPA Rating
Health hazard: 1
Fire Hazard: 0
Reactivity Hazard: 0

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.17 Revision Date: 03/03/2015 Print Date: 02/19/2016
1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Vanadium(V) oxide

Product Number : 204854
Brand : Aldrich
Index-No. : 023-001-00-8

CAS-No. : 1314-62-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO  63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Serious eye damage (Category 1), H318
Germ cell mutagenicity (Category 2), H341
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger

Hazard statement(s)
H302 + H332 : Harmful if swallowed or if inhaled
H318 : Causes serious eye damage.
H335 : May cause respiratory irritation.
H341 : Suspected of causing genetic defects.
H361 : Suspected of damaging fertility or the unborn child.
H372 : Causes damage to organs through prolonged or repeated exposure.
H411  Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201  Obtain special instructions before use.
P202  Do not handle until all safety precautions have been read and understood.
P260  Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264  Wash skin thoroughly after handling.
P270  Do not eat, drink or smoke when using this product.
P271  Use only outdoors or in a well-ventilated area.
P273  Avoid release to the environment.
P280  Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330  IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P304 + P340 + P312  IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338 + P310  IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313  IF exposed or concerned: Get medical advice/ attention.
P391  Collect spillage.
P403 + P233  Store in a well-ventilated place. Keep container tightly closed.
P405  Store locked up.
P501  Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula : $O_5V_2$
Molecular weight : 181.88 g/mol
CAS-No. : 1314-62-1
EC-No. : 215-239-8
Index-No. : 023-001-00-8

Hazardous components

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>Acute Tox. 4; Eye Dam. 1; Muta. 2; Repr. 2; STOT SE 3; STOT RE 1; Aquatic Acute 2; Aquatic Chronic 2; H302 + H332, H318, H335, H341, H361, H372, H411</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES
5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Vanadium/vanadium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES
6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE
7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
8.1 Control parameters
Components with workplace control parameters
<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>C</td>
<td>0.100000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>0.500000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>Ceiling limit is to be determined from breathing-zone air samples.</td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td></td>
<td></td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Upper Respiratory Tract irritation</td>
<td></td>
<td></td>
<td></td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.050000 mg/m³</td>
<td></td>
<td>Confirmed animal carcinogen with unknown relevance to humans</td>
</tr>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.050000 mg/m³</td>
<td></td>
<td>Confirmed animal carcinogen with unknown relevance to humans</td>
</tr>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.100000 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>Ceiling limit is to be determined from breathing-zone air samples.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.500000 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>Ceiling limit is to be determined from breathing-zone air samples.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.050000 mg/m³</td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.050000 mg/m³</td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.050000 mg/m³</td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>Biological occupational exposure limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>CAS-No.</td>
<td>Parameters</td>
<td>Value</td>
<td>Biological specimen</td>
</tr>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>Vanadium</td>
<td>0.0500 mg/g</td>
<td>In urine</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td>End of shift at end of workweek</td>
</tr>
</tbody>
</table>
8.2 Exposure controls

**Appropriate engineering controls**
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

**Personal protective equipment**

**Eye/face protection**
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

**Skin protection**
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

**Body Protection**
Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

**Control of environmental exposure**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: solid

b) Odour
   No data available

c) Odour Threshold
   No data available

d) pH
   No data available

e) Melting point/freezing point
   Melting point/range: 690 °C (1,274 °F) - lit.

f) Initial boiling point and boiling range
   No data available

g) Flash point
   Not applicable
h) Evaporation rate No data available
i) Flammability (solid, gas) No data available
j) Upper/lower flammability or explosive limits No data available
k) Vapour pressure No data available
l) Vapour density No data available
m) Relative density 3.35 g/mL at 25 °C (77 °F)
n) Water solubility 904 g/l at 20 °C (68 °F) - OECD Test Guideline 105
o) Partition coefficient: n-octanol/water No data available
p) Auto-ignition temperature No data available
q) Decomposition temperature No data available
r) Viscosity No data available
s) Explosive properties No data available
t) Oxidizing properties The substance or mixture is not classified as oxidizing.

9.2 Other safety information
   Solubility in other solvents Ethanol - insoluble

10. STABILITY AND REACTIVITY
10.1 Reactivity No data available
10.2 Chemical stability Stable under recommended storage conditions.
10.3 Possibility of hazardous reactions No data available
10.4 Conditions to avoid No data available
10.5 Incompatible materials Strong acids
10.6 Hazardous decomposition products
   Other decomposition products - No data available
   In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION
11.1 Information on toxicological effects
   Acute toxicity Harmful if swallowed. Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)
   LC50 Inhalation - Rat - female - 4 h - 2.21 mg/l
   (OECD Test Guideline 403)
   LC50 Dermal - Rat - > 2,500 mg/kg
   (OECD Test Guideline 402)
   No data available
Skin corrosion/irritation
Skin - in vitro assay
Result: No skin irritation

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Risk of serious damage to eyes.
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
In vitro tests showed mutagenic effects

Carcinogenicity
No data available

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Vanadium pentoxide)
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a
known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a
carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Possible risk of congenital malformation in the fetus.
Suspected human reproductive toxicant
No data available

Specific target organ toxicity - single exposure
May cause respiratory irritation.
Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: Not available
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly
investigated.
Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
Toxicity to fish LC50 - Oncorhynchus mykiss (rainbow trout) - 5.2 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates LC50 - Daphnia magna (Water flea) - 1.52 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available
12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
Toxic to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2862 Class: 6.1 Packing group: III
Proper shipping name: Vanadium pentoxide
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2862 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: VANADIUM PENTOXIDE
Marine pollutant: yes

IATA
UN number: 2862 Class: 6.1 Packing group: III
Proper shipping name: Vanadium pentoxide

15. REGULATORY INFORMATION

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 313 Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>

Pennsylvania Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-07-01</td>
</tr>
</tbody>
</table>
New Jersey Right To Know Components
Vanadium pentoxide

California Prop. 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer.

16. OTHER INFORMATION
Full text of H-statements referred to under sections 2 and 3.

- Acute Tox.
- Aquatic Acute
- Aquatic Chronic
- Eye Dam.
- H302
- H302 + H332
- H318
- H332
- H335
- H341
- H361
- H372
- H401

HMIS Rating
- Health hazard: 4
- Chronic Health Hazard: *
- Flammability: 0
- Physical Hazard: 0

NFPA Rating
- Health hazard: 3
- Fire Hazard: 0
- Reactivity Hazard: 0

Further information
Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8  Revision Date: 03/13/2015  Print Date: 01/29/2016
1 Identification

- Product identifier
- Trade name: VOC Gas Standard (1X1 mL)
- Part number: DWM-544-1
- Details of the supplier of the safety data sheet
- Manufacturer/Supplier:
  Agilent Technologies, Inc.
  5301 Stevens Creek Blvd.
  Santa Clara, CA  95051  USA
- Information department:
  Telephone: 800-227-9770
  e-mail: pdl-msds_author@agilent.com
- Emergency telephone number: CHEMTREC®: 1-800-424-9300

2 Hazard(s) identification

- Classification of the substance or mixture
  
  GHS02 Flame
  Flam. Liq. 2  H225  Highly flammable liquid and vapor.
  
  GHS06 Skull and crossbones
  Acute Tox. 3  H331  Toxic if inhaled.
  
  GHS08 Health hazard
  Carc. 1A  H350  May cause cancer.
  STOT SE 1  H370  Causes damage to organs.

- Label elements
- GHS label elements The product is classified and labeled according to the Globally Harmonized System (GHS).
- Hazard pictograms
  
  GHS02  GHS06  GHS08

- Signal word Danger
- Hazard-determining components of labeling:
  methanol
  vinyl chloride
  bromomethane
- Hazard statements
  Highly flammable liquid and vapor.
Precautionary statements

Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
IF exposed or concerned: Get medical advice/attention.
Specific treatment (see on this label).
In case of fire: Use for extinction: CO2, powder or water spray.
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

Classification system:

- NFPA ratings (scale 0 - 4)
  - Health = 1
  - Fire = 3
  - Reactivity = 0

- HMIS-ratings (scale 0 - 4)
  - Health = *1
  - Fire = 3
  - Reactivity = 0

Other hazards
- Results of PBT and vPvB assessment
  - PBT: Not applicable.
  - vPvB: Not applicable.

3 Composition/information on ingredients

- Chemical characterization: Mixtures
- Description: Mixture of the substances listed below with nonhazardous additions.

- Dangerous components:
  - 67-56-1 methanol 98.483%
  - 74-87-3 chloromethane 0.253%
  - 75-01-4 vinyl chloride 0.253%
4 First-aid measures

- Description of first aid measures
  - General information:
    Immediately remove any clothing soiled by the product.
    Remove breathing apparatus only after contaminated clothing have been completely removed.
    In case of irregular breathing or respiratory arrest provide artificial respiration.
  - After inhalation:
    Supply fresh air or oxygen; call for doctor.
    In case of unconsciousness place patient stably in side position for transportation.
  - After skin contact:
    Immediately wash with water and soap and rinse thoroughly.
  - After eye contact:
    Rinse opened eye for several minutes under running water. Then consult a doctor.
  - After swallowing:
    If symptoms persist consult doctor.
  - Information for doctor:
    No further relevant information available.

5 Fire-fighting measures

- Extinguishing media
  - Suitable extinguishing agents:
    CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
  - For safety reasons unsuitable extinguishing agents: Water with full jet

- Special hazards arising from the substance or mixture
  - During heating or in case of fire poisonous gases are produced.

- Advice for firefighters
  - Protective equipment: Mouth respiratory protective device.

6 Accidental release measures

- Personal precautions, protective equipment and emergency procedures
  - Mount respiratory protective device.
  - Wear protective equipment. Keep unprotected persons away.

- Environmental precautions: Do not allow to enter sewers/ surface or ground water.

- Methods and material for containment and cleaning up:
  - Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
  - Dispose contaminated material as waste according to item 13.
  - Ensure adequate ventilation.

- Reference to other sections
  - See Section 7 for information on safe handling.
  - See Section 8 for information on personal protection equipment.
  - See Section 13 for disposal information.

- Protective Action Criteria for Chemicals

  - PAC-1:
    67-56-1 methanol 530 ppm
Trade name: VOC Gas Standard (1X1 mL)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>74-87-3 chloromethane</td>
<td>150 ppm</td>
</tr>
<tr>
<td>74-83-9 bromomethane</td>
<td>19 ppm</td>
</tr>
<tr>
<td>75-01-4 vinyl chloride</td>
<td>250 ppm</td>
</tr>
<tr>
<td>75-71-8 dichlorodifluoromethane</td>
<td>3,000 ppm</td>
</tr>
<tr>
<td>75-69-4 trichlorofluoromethane</td>
<td>91 ppm</td>
</tr>
<tr>
<td>75-00-3 chloroethane</td>
<td>300 ppm</td>
</tr>
</tbody>
</table>

**PAC-2:**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-56-1 methanol</td>
<td>2,100 ppm</td>
</tr>
<tr>
<td>74-87-3 chloromethane</td>
<td>910 ppm</td>
</tr>
<tr>
<td>74-83-9 bromomethane</td>
<td>210 ppm</td>
</tr>
<tr>
<td>75-01-4 vinyl chloride</td>
<td>1,200 ppm</td>
</tr>
<tr>
<td>75-71-8 dichlorodifluoromethane</td>
<td>10,000 ppm</td>
</tr>
<tr>
<td>75-69-4 trichlorofluoromethane</td>
<td>1,000 ppm</td>
</tr>
<tr>
<td>75-00-3 chloroethane</td>
<td>5100 ppm*</td>
</tr>
</tbody>
</table>

**PAC-3:**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-56-1 methanol</td>
<td>7200* ppm</td>
</tr>
<tr>
<td>74-87-3 chloromethane</td>
<td>3,000 ppm</td>
</tr>
<tr>
<td>74-83-9 bromomethane</td>
<td>740 ppm</td>
</tr>
<tr>
<td>75-01-4 vinyl chloride</td>
<td>4800* ppm</td>
</tr>
<tr>
<td>75-71-8 dichlorodifluoromethane</td>
<td>50,000 ppm</td>
</tr>
<tr>
<td>75-69-4 trichlorofluoromethane</td>
<td>10,000 ppm</td>
</tr>
<tr>
<td>75-00-3 chloroethane</td>
<td>20000** ppm</td>
</tr>
</tbody>
</table>

7 Handling and storage

- **Handling:**
  - **Precautions for safe handling**
    Ensure good ventilation/exhaustion at the workplace.
    Open and handle receptacle with care.
    Prevent formation of aerosols.
  - **Information about protection against explosions and fires:**
    Keep ignition sources away - Do not smoke.
    Protect against electrostatic charges.
    Keep respiratory protective device available.

- **Conditions for safe storage, including any incompatibilities**

- **Storage:**
  - **Requirements to be met by storerooms and receptacles:** Store in a cool location.
  - **Information about storage in one common storage facility:** Not required.
  - **Further information about storage conditions:**
    Keep receptacle tightly sealed.
    Store in cool, dry conditions in well sealed receptacles.
  - **Specific end use(s)** No further relevant information available.
8 Exposure controls/personal protection

- Additional information about design of technical systems: No further data; see item 7.

- Control parameters

- Components with limit values that require monitoring at the workplace:

<table>
<thead>
<tr>
<th>Substance</th>
<th>PEL Long-term value</th>
<th>REL Short-term value</th>
<th>REL Long-term value</th>
<th>REL Skin limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-56-1 methanol</td>
<td>260 mg/m³, 200 ppm</td>
<td>325 mg/m³, 250 ppm</td>
<td>260 mg/m³, 200 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
</tr>
<tr>
<td>74-87-3 chloromethane</td>
<td>100 ppm</td>
<td>200; 300* ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*5-min peak in any 3 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See Pocket Guide App. A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75-01-4 vinyl chloride</td>
<td>1 ppm</td>
<td>207 mg/m³, 100 ppm</td>
<td>103 mg/m³, 50 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
</tr>
<tr>
<td>75-00-3 chloroethane</td>
<td>2600 mg/m³, 1000 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Handle with caution; See Pocket Guide App. C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
</tr>
</tbody>
</table>

- Ingredients with biological limit values:

<table>
<thead>
<tr>
<th>Substance</th>
<th>BEI</th>
<th>Medium</th>
<th>Time</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-56-1 methanol</td>
<td>15 mg/L</td>
<td>urine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Additional information: The lists that were valid during the creation were used as basis.

- Exposure controls
- Personal protective equipment:
- General protective and hygienic measures:
  Keep away from foodstuffs, beverages and feed.
  Immediately remove all soiled and contaminated clothing.
  Wash hands before breaks and at the end of work.
Store protective clothing separately.

**Breathing equipment:**
When used as intended with Agilent instruments, the use of the product under normal laboratory conditions and with standard practices does not result in significant airborne exposures and therefore respiratory protection is not needed.

Under an emergency condition where a respirator is deemed necessary, use a NIOSH or equivalent approved device/equipment with appropriate organic or acid gas cartridge.

**Protection of hands:**
Although not recommended for constant contact with the chemicals or for clean-up, nitrile gloves 11-13 mil thickness are recommended for normal use. The breakthrough time is 1 hr. For cleaning a spill where there is direct contact of the chemical, butyl rubber gloves are recommended 12-15 mil thickness with breakthrough times exceeding 4 hrs. Supplier recommendations should be followed.

**Material of gloves**
- For normal use: nitrile rubber, 11-13 mil thickness
- For direct contact with the chemical: butyl rubber, 12-15 mil thickness

**Penetration time of glove material**
- For normal use: nitrile rubber: 1 hour
- For direct contact with the chemical: butyl rubber: >4 hours

**Eye protection:**

![Tightly sealed goggles]

---

### 9 Physical and chemical properties

**Information on basic physical and chemical properties**

**General Information**
- **Appearance:** Fluid
  - **Form:** Fluid
  - **Color:** Colorless
- **Odor:** Alcohol-like
- **Odor threshold:** Not determined.
- **pH-value:** Not determined.

**Change in condition**
- **Melting point/Melting range:** -98 °C (-144.4 °F)
- **Boiling point/Boiling range:** 64.7 °C (148.5 °F)

**Flash point:** 9 °C (48.2 °F)

**Flammability (solid, gaseous):** Not applicable.

**Ignition temperature:** 455 °C (851 °F)

**Decomposition temperature:** Not determined.

**Auto igniting:** Product is not selfigniting.

**Danger of explosion:** Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
### 48.1.26

- **Explosion limits:**
  - Lower: 5.5 Vol %
  - Upper: 44 Vol %
- **Vapor pressure at 20 °C (68 °F):** 100 hPa (75 mm Hg)
- **Density at 20 °C (68 °F):** 0.80692 g/cm³ (6.73375 lbs/gal)
  - Relative density: Not determined.
  - Vapor density: Not determined.
  - Evaporation rate: Not determined.
- **Solubility in / Miscibility with Water:** Not miscible or difficult to mix.
- **Partition coefficient (n-octanol/water):** Not determined.
- **Viscosity:**
  - Dynamic: Not determined.
  - Kinematic: Not determined.
- **Solvent content:**
  - Organic solvents: 98.7 %
  - VOC content: 98.48 %
  - 794.7 g/l / 6.63 lb/gal
- **Solids content:** 0.0 %
- **Other information:** No further relevant information available.

### 10 Stability and reactivity

- **Reactivity:** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Possibility of hazardous reactions:** No dangerous reactions known.
- **Conditions to avoid:** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

### 11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity**:
- **LD/LC50 values that are relevant for classification:**
  - **ATE (Acute Toxicity Estimate)**
    - Oral LD50: 84,652 mg/kg (rat)
    - Inhalative LC50/4 h: 3.05 mg/L
  - **67-56-1 methanol**
    - Oral LD50: 5,628 mg/kg (rat)
    - Dermal LD50: 15,800 mg/kg (rabbit)
### 48.1.26

<table>
<thead>
<tr>
<th>Substance</th>
<th>Oral LD₅₀</th>
<th>Oral LD₅₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>chloromethane</td>
<td>1,800 mg/kg (rat)</td>
<td>&gt;21,800 mg/L (rat)</td>
</tr>
<tr>
<td>bromomethane</td>
<td>214 mg/kg (rat)</td>
<td>302 mg/L (rat)</td>
</tr>
<tr>
<td>vinyl chloride</td>
<td>500 mg/kg (rat)</td>
<td></td>
</tr>
<tr>
<td>trichlorofluoromethane</td>
<td>&gt;15,000 mg/kg (rat)</td>
<td>&gt;19,000 mg/L (rat)</td>
</tr>
</tbody>
</table>

### 12 Ecological information

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
  - **Bioaccumulative potential** No further relevant information available.
  - **Mobility in soil** No further relevant information available.
- **Additional ecological information:**
  - **General notes:**
    - Water hazard class 2 (Self-assessment): hazardous for water
    - Do not allow product to reach ground water, water course or sewage system.
    - Danger to drinking water if even small quantities leak into the ground.
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
13 Disposal considerations

- Waste treatment methods
  - Recommendation: Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

- Uncleaned packagings:
  - Recommendation: Disposal must be made according to official regulations.

14 Transport information

- Not Regulated, De minimus Quantities -

- UN-Number
  - DOT, IMDG, IATA UN1230

- UN proper shipping name
  - DOT Methanol
  - IMDG, IATA METHANOL

- Transport hazard class(es)
  - DOT
    - Class 3 Flammable liquids
    - Label 3, 6.1
  - IMDG
    - Class 3 Flammable liquids
    - Label 3/6.1
  - IATA
    - Class 3 Flammable liquids
    - Label 3 (6.1)

- Packing group
  - DOT, IMDG, IATA II
| 48.1.26 |  
| Environmental hazards: | Not applicable. |
| Special precautions for user | Warning: Flammable liquids |
| Danger code (Kemler): | 336 |
| EMS Number: | F-E,S-D |
| Stowage Category | B |
| Stowage Code | SW2 Clear of living quarters. |

|  
| Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code | Not applicable. |

|  
| Transport/Additional information: |
| DOT |
| Quantity limitations | On passenger aircraft/rail: 1 L  
| | On cargo aircraft only: 60 L |

| IMDG |
| Limited quantities (LQ) | 1L |
| Excepted quantities (EQ) | Code: E2  
| Maximum net quantity per inner packaging: 30 ml  
| Maximum net quantity per outer packaging: 500 ml |

| UN "Model Regulation": |
| UN 1230 METHANOL, 3 (6.1), II |

**15 Regulatory information**

| Safety, health and environmental regulations/legislation specific for the substance or mixture |
| Sara |

| Section 355 (extremely hazardous substances): |
| 74-83-9 bromomethane |

| Section 313 (Specific toxic chemical listings): |
| All ingredients are listed. |

| TSCA (Toxic Substances Control Act): |
| All ingredients are listed. |

| Proposition 65 |
| Chemicals known to cause cancer: |
| 75-01-4 vinyl chloride  
| 75-00-3 chloroethane |

| Chemicals known to cause reproductive toxicity for females: |
| None of the ingredients is listed. |

| Chemicals known to cause reproductive toxicity for males: |
| 74-87-3 chloromethane |

| Chemicals known to cause developmental toxicity: |
| 67-56-1 methanol  
| 74-87-3 chloromethane  
| 74-83-9 bromomethane |
Trade name: VOC Gas Standard (1X1 mL)

### Carcinogenic categories

#### EPA (Environmental Protection Agency)
- 74-87-3 chloromethane
- 74-83-9 bromomethane
- 75-01-4 vinyl chloride

#### TLV (Threshold Limit Value established by ACGIH)
- 74-87-3 chloromethane
- 74-83-9 bromomethane
- 75-01-4 vinyl chloride
- 75-71-8 dichlorodifluoromethane
- 75-69-4 trichlorofluoromethane
- 75-00-3 chloroethane

#### NIOSH-Ca (National Institute for Occupational Safety and Health)
- 74-87-3 chloromethane
- 74-83-9 bromomethane
- 75-01-4 vinyl chloride

#### National regulations:

- Additional classification according to Decree on Hazardous Materials:
  - Carcinogenic hazardous material group III (dangerous).

- Information about limitation of use:
  - Workers are not allowed to be exposed to the hazardous carcinogenic materials contained in this preparation. Exceptions can be made by the authorities in certain cases.

- Chemical safety assessment:
  - A Chemical Safety Assessment has not been carried out.

### 16 Other information

The information contained in this document is based on Agilent's state of knowledge at the time of preparation. No warranty as to its accurateness, completeness or suitability for a particular purpose is expressed or implied.

- **Department issuing SDS:** Document Control / Regulatory
- **Contact:** regulatory@ultrasci.com
- **Date of preparation / last revision:** 03/28/2019 / 3
- **Abbreviations and acronyms:**
  - ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
  - IMDG: International Maritime Code for Dangerous Goods
  - DOT: US Department of Transportation
  - IATA: International Air Transport Association
  - ACGIH: American Conference of Governmental Industrial Hygienists
  - EINECS: European Inventory of Existing Commercial Chemical Substances
  - ELINCS: European List of Notified Chemical Substances
  - CAS: Chemical Abstracts Service (division of the American Chemical Society)
  - NFPA: National Fire Protection Association (USA)
  - HMIS: Hazardous Materials Identification System (USA)
  - VOC: Volatile Organic Compounds (USA, EU)
  - LC50: Lethal concentration, 50 percent
  - LD50: Lethal dose, 50 percent
  - PBT: Persistent, Bioaccumulative and Toxic
  - vPvB: very Persistent and very Bioaccumulative
  - NIOSH: National Institute for Occupational Safety
Trade name: VOC Gas Standard (1X1 mL)

OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Liq. 2: Flammable liquids – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Carc. 1A: Carcinogenicity – Category 1A
STOT SE 1: Specific target organ toxicity (single exposure) – Category 1

* Data compared to the previous version altered.
SECTION 1: Identification of the substance/mixture and of the company/undertaking

Date issued 11.11.2013

1.1. Product identifier
Product name Xylene
Chemical name Xylene
Synonyms Xylol, dimethyl benzene, xylenol
REACH Reg No. 01-2119488216-32-0000
CAS no. 1330-20-7
EC no. 215-535-7
Index no. 601-022-00-9
Article no. 13000000

1.2. Relevant identified uses of the substance or mixture and uses advised against
Use of the substance/preparation For the preparation of paints and as a solvent. General purpose cleaner.

1.3. Details of the supplier of the safety data sheet
Manufacturer
Company name Fred Holmberg & Co AB
Office address Geijersgatan 8
Postal address Box 60056
Postcode S-216 10
City Limhamn
Country Sweden
Tel +46 (0)40 15 79 20
Fax +46 (0)40 16 22 95
E-mail info@holmberg.se
Website http://www.holmberg.se/en/

1.4. Emergency telephone number
Emergency telephone 112 (Europe)

SECTION 2: Hazards identification

2.1. Classification of substance or mixture
Classification according to Xi; R38
67/548/EEC or 1999/45/EC Xn; R20/21
R10
Classification according to Flam. Liq. 3; H226;
Regulation (EC) No 1272/2008 Acute tox. 4; H312;
[CLP/GHS] Skin Irrit. 2; H315;
Acute tox. 4; H332;

2.2. Label elements
Hazard Pictograms (CLP)
Signal word: Danger

Hazard statements:
- H226 Flammable liquid and vapour.
- H312 Harmful in contact with skin.
- H315 Causes skin irritation.
- H332 Harmful if inhaled.

Precautionary statements:
- P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
- P233 Keep container tightly closed.
- P243 Take precautionary measures against static discharge.
- P280 Wear protective gloves/protective clothing/eye protection/face protection.
- P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
- P331 Do NOT induce vomiting.
- P403 + P235 Store in a well-ventilated place. Keep cool.

2.3. Other hazards

Other hazards: Not known.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

<table>
<thead>
<tr>
<th>Substance</th>
<th>Identification</th>
<th>Classification</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylene</td>
<td>CAS no.: 1330-20-7</td>
<td>R10</td>
<td>75 - 90 %</td>
</tr>
<tr>
<td></td>
<td>EC no.: 215-535-7</td>
<td>Xi; R20/21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Index no.: 601-022-00-9</td>
<td>Flam. Liq. 3; H226</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acute tox. 4; H332</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acute tox. 4; H312</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skin Irrit. 2; H315</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Synonyms: Ethylbenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>CAS no.: 100-41-4</td>
<td>F; R11</td>
<td>10 - 25 %</td>
</tr>
<tr>
<td></td>
<td>EC no.: 202-849-4</td>
<td>Xi; R20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Index no.: 601-023-00-4</td>
<td>Flam. Liq. 2; H225</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Synonyms: Ethylbenzene</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Column headings:
- CAS no. = Chemical Abstracts Service; EU (Einecs or Elincs number) = European inventory of Existing Commercial Chemical Substances; Ingredient name = Name as specified in the substance list (substances that are not included in the substance list must be translated, if possible). Contents given in: %, %wt/wt, %vol/wt, %vol/vol, mg/m3, ppb, ppm, weight%, vol%.

HH/HF/HE:
- T+ = Very toxic, T = Toxic, C = Corrosive, Xn = Harmful, Xi = Irritating, E = Explosive, O = Oxidizing, F+ = Extremely flammable, F = Very flammable, N = Environmental hazard.

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:
Move the exposed person to fresh air at once. Get medical attention if any discomfort continues.

Skin contact:
Remove contaminated clothes and rinse skin thoroughly with water.

Eye contact:
Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Get medical attention if any discomfort continues.

Ingestion:
NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! Do not induce vomiting. Rinse mouth with water. Get medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Information for health personnel:
Treat Symptomatically. Do not give victim anything to drink if he is
4.3. Indication of any immediate medical attention and special treatment needed
Specific details on antidotes No recommendation given.

SECTION 5: Firefighting measures

5.1. Extinguishing media
Suitable extinguishing media Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog.

5.2. Special hazards arising from the substance or mixture
Fire and explosion hazards Solvent vapours may form explosive mixtures with air.
Hazardous combustion products Fire creates: Carbon monoxide (CO). Carbon dioxide (CO2).

5.3. Advice for firefighters
Fire fighting procedures No specific fire fighting procedure given.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Personal protection measures Ensure suitable personal protection (including respiratory protection) during removal of spillages in a confined area. Ventilate well. Stop leak if possible without risk. Avoid contact with skin and eyes. Do not breathe vapour.

6.2. Environmental precautions
Environmental precautionary measures Avoid discharge into drains, water courses or onto the ground.

6.3. Methods and material for containment and cleaning up
Cleaning method Dam and absorb spillages with sand, earth or other non-combustible material.

6.4. Reference to other sections
Other instructions No recommendation given.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Handling Keep away from heat, sparks and open flame. Take precautionary measures against static discharges. Mechanical ventilation may be required.

Protective Safety Measures
Advice on general occupational hygiene Provide easy access to water supply and eye wash facilities.

7.2. Conditions for safe storage, including any incompatibilities
Storage Keep away from heat, sparks and open flame. Ground container and transfer equipment to eliminate static electric sparks. Store in a cool and well-ventilated place.

7.3. Specific end use(s)
Specific use(s) Not entered.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters
DNEL / PNEC
Method of testing Contents
DNEL Group: Industrial
Exposure route: Inhalation
Exposure frequency: Short term (acute)
Critical Component: Ethylbenzen
Value: 289 mg/kg/dag
DNEL
Group: Industrial
Exposure route: Dermal
Exposure frequency: Long term (repeated)
Critical Component: Ethylbenzen
Type of effect: Systemic effect
Value: 3182 mg/kg/dag

DNEL
Group: Consumer
Exposure route: Inhalation
Exposure frequency: Long term (repeated)
Critical Component: Ethylbenzen
Type of effect: Systemic effect
Value: 260 mg/kg/dag
Xylene

DNEL

- Value: 65,3 mg/kg/dag
- Group: Consumer
- Exposure route: Dermal
- Exposure frequency: Long term (repeated)
- Critical Component: xylene
- Type of effect: Systemic effect
- Value: 1872 mg/kg/dag

DNEL

- Exposure route: Oral
- Exposure frequency: Long term (repeated)
- Critical Component: xylene
- Type of effect: Systemic effect
- Value: 12,5 mg/kg/dag

Exposure guidelines

- Country of origin: Sverige
- Limit value type: NGV 200 mg/m³
- OEL Short Term Value: 450 mg/m³
- Source: Nationella hygieniska gränsvärden, AFS 2005:17

Other Information

- Ovanstående NGV resp. KTV gäller både xylene och etylbenzen

8.2. Exposure controls

Occupational exposure limits

Provide adequate ventilation. Observe Occupational Exposure Limits and minimise the risk of inhalation of vapours. Protective gloves and goggles are recommended. Provide eyewash, quick drench.

Safety signs

Respiratory protection

Respiratory protection must be used if air contamination exceeds acceptable level. Use respiratory equipment with gas filter, type A2.

Hand protection

Hand protection

Use protective gloves. Chemical resistant gloves required for prolonged or repeated contact. Gloves of nitrile rubber, PVA or Viton are recommended.

Eye / face protection

Eye protection

Use safety goggles or face shield in case of splash risk.

Skin protection

Skin protection (except hands)

Wear appropriate clothing to prevent any possibility of skin contact.

Hygiene / Environmental

Specific hygiene measures

Wash hands after contact.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state: Fluid.
- Colour: Colourless.
- Odour: Aromatic.
- Comments, pH (as supplied): Not relevant.
- Melting point/melting range: Value: < -48 °C
- Boiling point / boiling range: Value: 136-145 °C
- Flash point: Value: 27 °C
- Evaporation rate: Value: 13,5
- Explosion limit: Value: 1-7,1 %
- Vapour pressure: Value: 1 kPa

Test temperature: 20 °C
Vapour density Value: 3,7
Specific gravity Value: 0,870 kg/m³
Test temperature: 20 °C
Partition coefficient: n-octanol/water Value: 3,15
Spontaneous combustability Value: > 432-530 °C
Viscosity Value: < 0,90 mPas
Method of testing: Kinematisk
Test temperature: 25 °C

9.2. Other information

SECTION 10: Stability and reactivity

10.1. Reactivity
Reactivity Heating may cause a fire.

10.2. Chemical stability
Stability Stable under the prescribed storage conditions.

10.3. Possibility of hazardous reactions
Possibility of hazardous reactions Not known.

10.4. Conditions to avoid
Conditions to avoid Avoid heat, flames and other sources of ignition.

10.5. Incompatible materials
Materials to avoid Avoid contact with oxidising agents (e.g. nitric acid, peroxides and chromates). Strong acids.

10.6. Hazardous decomposition products
Hazardous decomposition products Fire creates: Carbon monoxide (CO). Carbon dioxide (CO2).

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Toxicological Information:
Other toxicological data Acute Toxicity (Oral LD50): mg/kg (oral rat) > 2000
Acute Toxicity (Inhalation LC50): mg/l (vapours) (4h) > 20
Acute Toxicity (Dermal LD50): mg/kg Rabbit > 2000

Toxicological data for substances
Potential acute effects
Inhalation In high concentrations, vapours are narcotic and may cause headache, fatigue, dizziness and nausea. Icke klassificerad som aspirationstoxisk (Not classified as asp. tox.).
Skin contact Prolonged or frequent contact may cause redness, itching, eczema and skin cracking. Defats the skin.
Eye contact May irritate and cause redness and pain.
Ingestion Ingestion of large amounts may cause unconsciousness. However, ingestion may cause nausea, headache, dizziness and intoxication. Ingestion may cause irritation of the gastrointestinal tract, vomiting and diarrhoea. May cause irritation to the mouth and throat.

Delayed effects / repeated exposure
Sensitisation Not known.
Chronic effects None known.
Carcinogenic, Mutagenic or Reprotoxic
Carcinogenicity None.
Mutagenicity Not known.
Teratogenic properties Suspected of damaging the unborn child.
Reproductive toxicity Not known.

SECTION 12: Ecological information

12.1. Toxicity
Acute aquatic, fish Value: 2 mg/l
Method of testing: LC50
Fish, species: Roccus saxatilis
Duration: 96h
Acute aquatic, algae Value: > 3.2 mg/l
Method of testing: IC50
Algae, species: Selenastrum Capricornum
Duration: 72h
Acute aquatic, Daphnia Value: 8.5 mg/l
Method of testing: EC50
Daphnia, species: Daphnia magna
Duration: 48h

12.2. Persistence and degradability
Persistence and degradability Lättndbrytbar av biologiska organismer.
Chemical oxygen demand (COD) Value: 5
Method of testing: COD
Biological oxygen demand (BOD) Value: 0.55
Method of testing: BOD

12.3. Bioaccumulative potential
Bioaccumulative potential Will not bio-accumulate.
Bioconcentration factor (BCF) Value: 22
Method of testing: BCF

12.4. Mobility in soil
Mobility The product is insoluble in water and will spread on the water surface.

12.5. Results of PBT and vPvB assessment
PBT assessment results This substance is not classified as PBT or vPvB.

12.6. Other adverse effects
Other adverse effects / Remarks None known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Specify the appropriate methods of disposal
Product classified as hazardous waste Yes
Packaging classified as hazardous waste Yes

SECTION 14: Transport information

14.1. UN number
ADR 1307
RID 1307
IMDG 1307
ICAO/IATA 1307

14.2. UN proper shipping name
ADR XYLENES
RID  XYLENES
IMDG  XYLENES
ICAO/IATA  XYLENES

14.3. Transport hazard class(es)
ADR  3
Hazard no.  30
RiD  3
ADN  33
IMDG  3
ICAO/IATA  3

14.4. Packing group
ADR  III
RiD  III
IMDG  III
ICAO/IATA  III

14.5. Environmental hazards
Comment  Not relevant.

14.6. Special precautions for user
EmS  F-E, S-D

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

SECTION 15: Regulatory information
EC no.  215-535-7

15.1. Safety, health and environmental regulations/legislation specific for the
substance or mixture

Legislation and regulations  Dangerous Substance Directive 67/548/EEC.

15.2. Chemical safety assessment

SECTION 16: Other information

Hazard symbol

R-phrases  R10 Flammable.
R38 Irritating to skin.
R20/22 Harmful by inhalation and if swallowed.
R38 Irritating to skin.

S-phrases  S7 Keep container tightly closed.
S16 Keep away from sources of ignition - No smoking.

Classification according to  Flam. Liq. 3; H226;
[CLP/GHS]  Acute tox. 4; H312;
Skin Irrit. 2; H315;
List of relevant R-phrases (under headings 2 and 3).
R38 Irritating to skin.
R11 Highly flammable.
R10 Flammable.
R20/21 Harmful by inhalation and in contact with skin.
R20 Harmful by inhalation.

List of relevant H-phrases (Section 2 and 3).
H332 Harmful if inhaled.
H312 Harmful in contact with skin.
H225 Highly flammable liquid and vapour.
H226 Flammable liquid and vapour.
H315 Causes skin irritation.

Responsible for safety data sheet Fred Holmberg & Co AB
Material Safety Data Sheet
Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

<table>
<thead>
<tr>
<th>Product Name: Zinc Metal</th>
<th>Contact Information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204</td>
<td>Sciencelab.com, Inc.</td>
</tr>
<tr>
<td>CAS#: 7440-66-6</td>
<td>14025 Smith Rd.</td>
</tr>
<tr>
<td>RTECS: ZG8600000</td>
<td>Houston, Texas 77396</td>
</tr>
<tr>
<td>TSCA: TSCA 8(b) inventory: Zinc Metal</td>
<td>US Sales: 1-800-901-7247</td>
</tr>
<tr>
<td>Cl#: Not applicable.</td>
<td>International Sales: 1-281-441-4400</td>
</tr>
<tr>
<td>Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips</td>
<td>CHEMTREC (24HR Emergency Telephone), call:</td>
</tr>
<tr>
<td>Chemical Name: Zinc Metal</td>
<td>1-800-424-9300</td>
</tr>
<tr>
<td>Chemical Formula: Zn</td>
<td>International CHEMTREC, call: 1-703-527-3887</td>
</tr>
<tr>
<td></td>
<td>For non-emergency assistance, call: 1-281-441-4400</td>
</tr>
</tbody>
</table>

Section 2: Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Composition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Zinc Metal</td>
</tr>
</tbody>
</table>

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
**Skin Contact:** Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

**Serious Skin Contact:** Not available.

**Inhalation:**
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

---

**Section 5: Fire and Explosion Data**

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 480°C (896°F)

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:**
Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

**Special Remarks on Fire Hazards:**
Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, postassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.

**Special Remarks on Explosion Hazards:** Not available.

---

**Section 6: Accidental Release Measures**

**Small Spill:**
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**
Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.
Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

**Storage:**
Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:** Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:** Not available.

Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Lustrous solid. Metal solid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 65.39 g/mole

**Color:** Bluish-grey

**pH (1% soln/water):** Not applicable.

**Boiling Point:** 907°C (1664.6°F)

**Melting Point:** 419°C (786.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Not available.

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.
**Section 10: Stability and Reactivity Data**

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, incompatible materials, moisture

**Incompatibility with various substances:** Reactive with oxidizing agents, acids, alkalis. Slightly reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Incompatible with acids, halogenated hydrocarbons, NH4NO3, barium oxide, Ba(NO3)2, Cadmium, CS2, chlorates, Cl2, CrO3, F2, Hydroxylamine, Pb(N3)2, MnCl2, HNO3, performic acid, KClO3, KNO3, N2O2, Selenium, NaClO3, Na2O2, Sulfur, Te, water, (NH4)2S, As2O3, CS2, CaCl2, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H2SO4, (Mg +Ba(NO3)2 +BaO2), (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

---

**Section 11: Toxicological Information**

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**
LD50: Not available. LC50: Not available.

**Chronic Effects on Humans:** Not available.

**Other Toxic Effects on Humans:** Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects: Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: May cause eye irritation. Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investigated.

---

**Section 12: Ecological Information**

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation: Not available.
Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).
Identification: Not applicable.
Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.
Other Classifications:
WHMIS (Canada): Not Available

DSCL (EEC):
R15- Contact with water liberates extremely flammable gases. R17- Spontaneously flammable in air. S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):
Health Hazard: 1
Fire Hazard: 1
Reactivity: 1
Personal Protection: E

National Fire Protection Association (U.S.A.):
Health: 0
Flammability: 1
Reactivity: 1
Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information
The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.
APPENDIX D

QUALITY ASSURANCE PROJECT PLAN
QUALITY ASSURANCE
PROJECT PLAN

2560-2580 Boston Road
Bronx, New York

Prepared For:
SPG 2560 Boston Road LLC
440 Park Avenue South, 3rd Flr
New York, NY 10016

Prepared By:
Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.
360 West 31st Street, 8th Floor
New York, New York 10001
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Attachment D Analytical Methods/Quality Assurance Summary Table
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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is for the about 53,500-square-foot site is located at 2560-2580 Boston Road in the Allerton neighborhood of the Bronx, New York and is identified as Block 4440, Lots 16, 30 and 32 on the Bronx County Tax Map. Lot 16 is currently occupied by an active one-story supermarket with a full basement used for food storage and an associated asphalt-paved parking lot. Lot 30 is developed with a vacant two-story building with a full cellar that was most recently used as an attorney’s office, and was also historically used as a daycare. The northern half of Lot 30 contains a private outdoor space. Lot 32 is improved with an active one-story office building with an associated garage used for general storage. An about 6-foot-high, 6-by-10-foot cellar is also present in the northwestern part of the building. The northern corner of Lot 32 is paved and adjoins the sidewalks along Boston Road and Matthews Avenue. Block 4440 is bordered by Boston Road to the north, Matthews Avenue to the East, Mace Avenue to the south, and Barnes Avenue to the west.

This QAPP specifies analytical methods to be used to ensure that data collected during the Remedial Investigation (RI) is precise, accurate, representative, comparable, complete, and meets the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The objective of the scope of work is to investigate and characterize the nature and extent of environmental impacts at the site and to provide sufficient information to evaluate remedial alternatives and threats to human health and the environment, as required per the BCP.

1.3 SCOPE OF WORK

The scope of work covered in this QAPP is detailed in the Remedial Investigation Work Plan (RIWP). In general, the RIWP proposes soil boring installation and sampling, groundwater monitoring well installation and sampling, and soil vapor sampling. A dust, odor, and vapor control and monitoring plan will be implemented during ground intrusive activities. The following investigation activities will be performed as part of the RIWP:

- Advance 37 soil borings to either the first underlying depth interval without evidence of impacts or fill or to about 20 feet bgs, whichever is deeper.

- Collect up to three samples from each soil borings for a total of 111 soil samples (plus quality assurance/quality control [QA/QC] samples) for laboratory analysis.
• Advance 18 soil borings to about 5 feet below the water table to install and develop 18 permanent monitoring wells.

• Collect one groundwater sample from each monitoring well (plus QA/QC samples) for laboratory analysis.

• Survey and gauge monitoring wells to establish groundwater elevations and evaluate flow direction.

• Develop a groundwater contour map.

• Install 13 soil vapor points to about 2 feet above the observed groundwater table.

• Collect 13 soil vapor samples and one ambient air sample for laboratory analysis.

• Implementation of a community air monitoring plan (CAMP)

The proposed sample location plan is included as Attachment A, which is also provided as Figures 7A and 7B in the RIWP.
2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The quality of the data must be sufficient to fulfill the overall objective of the RI. The overall objective is to investigate and characterize the nature and extent of environmental impacts at and emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. The RIWP specifies the intended use of the data, the required constituents of interest, limits of detection, level of data assessment, and data deliverables. All data shall be defined as definitive data.

The DQO process is an iterative process where various options for implementing a project are explored, dissected, and recombined. The feasibility and costs of various options are estimated, and then the most advantageous option is selected and developed into project work plans that will be implemented.

DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations, based on comparison to Title 6 of the Official Compilation of New York Codes, Rules and Regulations Part 375 NYSDEC Unrestricted Use Soil Cleanup Objectives for soil samples and to the New York State Department of Health (NYSDOH) “Guidance for Evaluating Soil Vapor Intrusion in the State of New York” (October 2006, with updates February 2024) for soil vapor samples.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

The investigation will be evaluated using the DQO process on an individual, task-specific basis. DQOs and the required level of review will be determined during this process.
3.0 PROJECT ORGANIZATION

Langan will arrange data analysis and reporting tasks related to the site sampling. The analytical services will be performed by an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Data validation services will be performed by approved data validation contractor(s).

The required sampling will be conducted by Langan; the analytical services will be performed by Alpha Analytical, Inc. of Westborough, Massachusetts NYSDOH ELAP certification number 11148). Data validation services will be performed by Joseph Conboy of Langan.

Resumes for Langan personnel can be found in Attachment B; key contacts for this project are as follows:

- **Slate Property Group:** David Schwartz  
  Telephone: 646-439-4000

- **Langan Project Manager:** Lamees Esmail, PE  
  Telephone: (212) 479-5499

- **Langan Field Team Leader:** Meghan Aronica, EIT  
  Telephone: (716) 525-7260

- **Langan Health & Safety Officer:** Tony Moffa, CHMM  
  Telephone: (215) 491-6500

- **Langan Quality Assurance Manager:** Brian Gochenaur, QEP  
  Telephone: (212) 479-5479

- **Langan Data Validator:** Joseph Conboy  
  Telephone: (609) 282-8055

- **Laboratory Representative:** Alpha Analytical, Inc.  
  Ben Rao  
  Telephone: (201) 812-2633
4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance objective is to develop and implement procedures for sampling, laboratory analysis, field measurements, and reporting that will provide data of sufficient quality to evaluate the engineering controls on the site. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the site. Quality assurance objectives are usually expressed in terms of precision, accuracy or bias, representativeness, completeness, comparability, and sensitivity of analysis. Variances from the quality assurance objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 PRECISION

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. The following field duplicate precision criteria will be applied:

**Aqueous and Canister Air Samples**
- Results greater than 5 times the laboratory reporting limit (RL) must have a relative percent difference (RPD) ≤ 30%.
- Results less than 5 times the RL must have an absolute difference ≤ ±RL.

**Soil Samples**
- Results greater than 5 times the laboratory RL must have a RPD ≤ 50%.
- Results less than 5 times the RL must have an absolute difference ≤ 2× ±RL.

**Soil Vapor Samples**
- Results greater than 5 times the laboratory RL must have a RPD ≤ 50%.
- Results less than 5 times the RL must have an absolute difference ≤ 2× ±RL.

RLs and method detection limits (MDL) are provided in Attachment C.

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD) and subsequent calculation of RPD. For outliers, if additional sample volume is present, the MS/MSD
should be reanalyzed and the RPD recomputed. If additional volume is not present, an evaluation will be performed to determine the extent of potential matrix interference.

4.2 ACCURACY

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of field and trip blanks and through compliance to all sample handling, preservation, and holding time requirements. All field and trip blanks should be non-detect when analyzed by the laboratory. Any contaminant detected in an associated field blank will be evaluated against laboratory blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias.

Laboratory accuracy is assessed by evaluating the percent recoveries of MS/MSD samples, LCS/LCSD, surrogate compound recoveries, internal standard area counts, initial and continuing calibrations, and the results of method, initial and continuing calibration blanks. MS/MSD, LCS/LCSD, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be non-detect when analyzed by the laboratory.

4.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. This is performed by following applicable standard operating procedures (SOPs) and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance with nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory’s possession. This is performed by following all applicable analytical
methods, laboratory-issued SOPs, the laboratory’s Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.4 **COMPLETENESS**

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Soil, groundwater and soil vapor data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

4.5 **COMPARABILITY**

Comparability is an expression of the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling plan is followed and that sampling is performed according to the SOPs or other project-specific procedures. Analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability will be controlled by requiring the use of specific nationally-recognized analytical methods and requiring consistent method performance criteria. Comparability is also dependent on similar quality assurance objectives. Previously collected data will be evaluated to determine whether they may be combined with contemporary data sets.

4.6 **SENSITIVITY**

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and quality assurance personnel, sampling and analytical procedures that achieve the required levels of detection and quality control acceptance limits that meet established performance criteria. Concurrently, the project manager will select the level of data assessment to ensure that only data meeting the project DQOs are used in decision-making.
Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment D. The frequency of associated field blanks, trip blanks and duplicate samples will be based on the recommendations listed in DER-10, and as described in Section 5.3.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. A MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.
5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Soil and groundwater sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10/Technical Guidance for Site Investigation and Remediation (May 2010). Sub-slab and soil vapor sampling will be conducted in accordance with NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006, with updates February 2024). The following sections describe procedures to be followed for specific tasks.

5.1 FIELD DOCUMENTATION PROCEDURES

Field documentation procedures will include summarizing field data in field books and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks contain the documentary evidence regarding procedures conducted by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. The pages of the notebook will not be removed.

Entries will be made in waterproof, permanent blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry will be dated. Entries will be legible and contain accurate and complete documentation of the individual or sampling team’s activities or observations made. The level of detail will be sufficient to explain and reconstruct the activity conducted. Each entry will be signed by the person(s) making the entry.

The following types of information will be provided for each sampling task, as appropriate:

- Project name and number
- Reasons for being on-site or taking the sample(s)
- Date and time of activity
- Sample identification number(s)
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system; sketches will be made in the field logbook when appropriate
- Physical location of sampling locations such as depth below ground surface
• Description of the method of sampling including procedures followed, equipment used and any departure from the specified procedures

• Description of the sample including physical characteristics, odor, etc.

• Readings obtained from health and safety equipment

• Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample

• Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera

• Other pertinent observations such as the presence of other persons on the site, actions by others that may affect performance of site tasks, etc.

• Names of sampling personnel and signature of persons making entries

Field records will also be collected on field data sheets including boring logs, which will be used for geologic and drilling data during soil boring activities. Field data sheets will include the project-specific number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number and abbreviation in accordance with the sample nomenclature guidance provided in the following table and the Standard Operating Procedure provided in Attachment E.

<table>
<thead>
<tr>
<th>Sample Nomenclature Summary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Ambient Air</td>
</tr>
<tr>
<td>IA</td>
<td>Indoor Air</td>
</tr>
<tr>
<td>DUP</td>
<td>Field Duplicate</td>
</tr>
<tr>
<td>EB</td>
<td>Environmental Boring</td>
</tr>
<tr>
<td>LB</td>
<td>Langan Boring</td>
</tr>
<tr>
<td>SB</td>
<td>Soil Boring</td>
</tr>
<tr>
<td>FB</td>
<td>Field Blank</td>
</tr>
<tr>
<td>MW</td>
<td>Monitoring Well</td>
</tr>
<tr>
<td>SV</td>
<td>Soil Vapor</td>
</tr>
<tr>
<td>SSV</td>
<td>Sub-Slab Soil Vapor</td>
</tr>
<tr>
<td>TB</td>
<td>Trip Blank</td>
</tr>
<tr>
<td>(#-#)</td>
<td>Depth Interval</td>
</tr>
<tr>
<td>MMDDYY</td>
<td>Date of Sampling</td>
</tr>
</tbody>
</table>
Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis required and chemical preservatives added, if any. All documentation will be completed in waterproof ink.

5.2 EQUIPMENT CALIBRATION AND PREVENTATIVE MAINTENANCE

A PID will be used during the sampling activities to evaluate work zone action levels, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the Site Health & Safety Officer, and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or similar) will be used during purging of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes, or, depending on pump flow rate, after at least one full volume of the water quality meter flow through cell has passed through. A portable turbidity meter (LaMotte or similar) may also be used to measure turbidity. Water-quality meters should be calibrated and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer’s specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer’s recommendations and
specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled and unscheduled maintenance.

5.3 SAMPLE COLLECTION

Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from VOCs and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either En Core® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons and homogenized in unused sterile polyethylene zipper bags. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Sections 5.4 and 5.6. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in Attachment D. In addition, analysis of collected soil samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

Groundwater Samples


During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes using a water quality meter (YSI 6820 or similar) and a depth-to-water interface probe that should be decontaminated between wells. Samples should generally not be collected until the field parameters have stabilized. Field parameters will be considered stable once three sets of measurements are within ±0.1 standard units for pH, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should be collected after parameters have...
stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Samples should be collected directly into laboratory-supplied jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Sections 5.4 and 5.6. Analysis and/or extraction and digestion of collected groundwater samples will meet the holding times required for each analyte as specified in Attachment D. In addition, analysis of collected groundwater samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

**Soil Vapor and Ambient Air Samples**

Prior to soil vapor and ambient air sample collection, a pre-sampling inspection will be conducted to document chemicals and potential subsurface pathways at the site. The pre-sampling inspection will assess the potential for impacts from any chemical or petroleum storage within the on-site buildings. Soil vapor and ambient air samples will be collected into laboratory-supplied, batch certified-clean Summa® canisters calibrated for a sampling rate of eight hours. Sub-slab soil vapor and indoor air samples will be collected into laboratory-supplied, individual certified-clean Summa® canisters calibrated for a sampling rate of eight hours. The pressure gauges on each calibrated flow controller should be monitored throughout sample collection. Sample collection should be stopped when the pressure reading reaches -4 mmHg.

**Emerging Contaminant Samples**

Soil and groundwater samples collected for analysis of per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane will be collected in accordance with the specialized protocol outlined in this section and the *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) under NYSDEC’s Part 375 Remedial Programs*, issued by the NYSDEC in April 2023. Soil and groundwater samples collected from select sample locations will be analyzed for 1,4-dioxane by EPA Method 8270 and for PFAS by EPA Method 1633 Modified in accordance with the procedure outlined in Attachment F.

Soil samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis.

Groundwater sampling will be performed using low-flow sampling procedures following USEPA guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", January 19, 2017). Groundwater samples will
be collected using a peristaltic pump fitted with dedicated, non-Teflon high-density polyethylene (HDPE) tubing and using low-flow purging techniques to minimize drawdown. A Horiba U-52 (or similar) will be used to monitor water quality parameters (pH, conductivity, temperature, dissolved oxygen, oxidation-reduction-potential (ORP), and turbidity. Groundwater samples will be collected after the parameters stabilized within about 10 percent of consecutive values, to the extent practical, and turbidity is below 10 nephelometric turbidity units (NTU).

Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex or Tyvek will be worn during sampling. Non-disposable components of the pump will be decontaminated with Alconox and water. Field personnel will wear nitrile gloves while collecting and handing soil and groundwater samples.

Sample Field Blanks, Equipment Blanks, Trip Blanks and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per 20 investigative samples per matrix (soil and groundwater only). Field blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling. To assess contamination resulting from sample transport, trip blanks will be collected at a rate of one per day if soil or groundwater samples are analyzed for VOCs during that day. Field blanks and equipment blanks collected for PFAS will be collected at a minimum of one per day or one per 20 investigative samples per matrix; whichever frequency is higher.

Equipment blanks will be collected for quality assurance purposes at a rate of one per day per matrix for soil and groundwater PFAS samples. Field blanks will be obtained by pouring laboratory-demonstrated PFAS-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis.

Duplicate soil and groundwater samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 investigative samples per matrix and will be submitted to the laboratory as “blind” samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. If soil samples or groundwater are being collected, the laboratory will also prepare and supply the
required trip blanks and field blank sample containers and reagent preservatives. Sample bottle containers, including the field blank containers, will be placed into plastic coolers by the laboratory. These coolers will be received by the field sampling team within 24 hours of their preparation in the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to maintain a temperature of 4° ±2°C.

Soil and/or groundwater samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. The temperature in the coolers containing samples and associated field blanks will be maintained at a temperature of 4°±2°C while on-site and during sample shipment to the analytical laboratory.

Soil and groundwater sampling for PFAS will be collected in accordance with EPA Method 1633 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene (HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex™ or Tyvek® will be worn during sampling.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.9, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.6.

5.5 SAMPLE PRESERVATION

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the requirements of the specific analytical method selected, as shown in Attachment D.

5.6 SAMPLE SHIPMENT

5.6.1 Packaging

Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc® bags (or equivalent) will be placed around sample containers. Cushioning material will be added around the sample containers if necessary. Chains-of-custody and other paperwork will be placed in a
Ziploc® bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler.

5.6.2 Shipping

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

- All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols described in Section 5.9.

- Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

5.7 DECONTAMINATION PROCEDURES

5.7.1 Decontamination General Sample Collection

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific sample Health and Safety Plan (HASP) included in Appendix C of the RIWP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
2. Generous tap water rinse
3. Distilled/de-ionized water rinse

5.7.2 Decontamination for PFAS Sample Collection

In addition to general decontamination procedures are outlined in Section 5.7.1, sampling equipment will be thoroughly decontaminated before mobilization and between sample locations. Field sampling equipment, including water level indicators and other non-dedicated equipment, requires cleaning between uses. Non-dedicated equipment used for PFAS sampling will be rinsed using a three bucket rinse procedure. An about 3-gallon solution of decontamination fluid consisting of Alconox or Citranox and deionized (DI) water will be prepared in a 5-gallon bucket for the first equipment rinse. A second 5-gallon bucket will be filled with about 3 gallons of DI water for the second rinse. A third 5-gallon bucket will be filled with about 3 gallons of DI water for the final rinse. Powderless nitrile (non-latex) gloves will be donned during the handling of
sampling equipment and sample containers. The Safety Data Sheets of detergents used in decontamination procedures will be reviewed to ensure fluoro-surfactants and 1,4-dioxane are not listed as ingredients. Laboratory-verified PFAS-free water will be used as the final rinse during decontamination of sampling equipment.

5.8 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable personal protective equipment) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Soil cuttings with no apparent staining, odors, or elevated PID readings will be used to backfill boring holes. Soil to be disposed off-site will be placed in 55-gallon, UN/Department of Transportation (DOT) approved drums. Decontamination and well development/purging fluids will be placed in DOT-approved fluid drums with closed tops. All drums will be properly labeled, sealed, and characterized as necessary.

If initial analytical data is insufficient to gain disposal facility acceptance, waste characterization samples will be analyzed for parameters that are typically required by disposal facilities, such as target compounds list (TCL) VOCs, semivolatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) metals, polychlorinated biphenyls (PCBs), pesticides, herbicides, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, ignitability, corrosivity, reactivity, and paint filter. Additional sampling and analyses may be required based on the selected disposal facility.

Samples will be collected in accordance with the selected disposal facility’s requirements and will be collected to be representative of the material requiring disposal at a frequency consistent with disposal facility requirements. It is anticipated that all drummed material will be transported off-site and disposed of at a permitted facility.

5.9 CHAIN OF CUSTODY PROCEDURES

A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.

Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.

When the form is full or when all samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Any necessary corrections will be made to the record with a single strike mark, dated, and initialed.

When soil and groundwater samples are collected, sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc® bag (or equivalent) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as Figure 5.1, and an example chain-of-custody form for soil and groundwater samples is included as Figure 5.2.
Figure 5.1 Sample Custody

1. PREPARATION OF SAMPLE CONTAINERS
2. SAMPLES COLLECTED BY SAMPLING TEAM
3. SAMPLES LABELED
4. SEALED IN INSULATED COOLER WITH ICE
5. SHIPMENT TO LABORATORY**
6. SAMPLE RECEIPT AT LAB **
7. CHECK SAMPLE INTEGRITY **
8. STORAGE IN SECURE AREA
9. CHECK OUT FOR ANALYSIS **
10. RETURN TO STORAGE OR DISPOSAL

** REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM
Figure 5.2 Sample Chain-of-Custody Form – Soil and Groundwater Samples

<table>
<thead>
<tr>
<th>Project Information</th>
<th>Deliberates</th>
<th>Location</th>
<th>Billing Information</th>
<th>Disposal Site Information</th>
<th>Regulatory Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td>ASPA</td>
<td>Project Location:</td>
<td>ASPB</td>
<td>Equil (1 file)</td>
<td>NY, USGS</td>
</tr>
<tr>
<td>Project Location:</td>
<td>Equil (2 files)</td>
<td>Weatherford, TX 76102</td>
<td>Equil (2 files)</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
</tr>
<tr>
<td>Project #:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Client Information</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Use Project Name as Project #:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Project #:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Phone:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Turn-Around Time:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td>Due Date:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
<tr>
<td># of Days:</td>
<td>NY, USGS</td>
<td>Weatherford, TX 76102</td>
<td>NY, Part 375</td>
<td>NY, Part 375</td>
<td>Other</td>
</tr>
</tbody>
</table>

These samples have been previously analyzed by Alpha.

Other project specific requirements/comments:

Please specify Metals or TAL:

Alpha Lab ID (Lab Use Only):

Sample ID:

Collection Date:

Sample Matrix:

Sample’s Initials:

Preservative Code:

Container Code:

Westboro Certification No: MA-035
Manufakturf Certification No: MA-015

Container Type:

Preservative:

Requiem By: Date/Time

Received By: Date/Time

Print clearly, legibly and completely. Samples cannot be logged in and must be immediately placed in the correct container. If any ambiguities are received, the sample will not be accepted.
Figure 5.3  Sample Chain-of-Custody Form – Soil Vapor and Ambient Air Samples

<table>
<thead>
<tr>
<th><strong>AIR ANALYSIS</strong></th>
<th><strong>CHAIN OF CUSTODY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Information</strong></td>
<td><strong>Report Information - Data Deliverables</strong></td>
</tr>
<tr>
<td>Project Name:</td>
<td>Report Information:</td>
</tr>
<tr>
<td>Project Location:</td>
<td>Data Deliverables:</td>
</tr>
<tr>
<td>Project #:</td>
<td>Requirements:</td>
</tr>
<tr>
<td><strong>Billing Information</strong></td>
<td><strong>Regulatory Requirements/Report Limits</strong></td>
</tr>
<tr>
<td># Same as Client Info</td>
<td>State/Fed</td>
</tr>
<tr>
<td># PO #:</td>
<td>Program</td>
</tr>
<tr>
<td># Other Formats:</td>
<td>Total Comm</td>
</tr>
</tbody>
</table>

**ALPHA Quote #:**

**Client Information**

- **Address:**
- **Project Manager:**
- **Phone:**
- **Fax:**
- **Email:**

**These samples have been previously analyzed by Alpha**

**Other Project Specific Requirements/Comments:**

- **Project-Specific:**
- **Target Compound List:**

<table>
<thead>
<tr>
<th><strong>All Columns Below Must Be Filled Out</strong></th>
<th><strong>ALPHA Lab ID</strong> (Lab Use Only)</th>
<th>Sample ID</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COLLECTION</strong></td>
<td>Sample ID</td>
<td>Initial Samples</td>
</tr>
<tr>
<td>Sample Matrix</td>
<td>Sample Matrix</td>
<td></td>
</tr>
</tbody>
</table>

**SAMPLE MATRIX CODES**

- **A:** Ambient Air (Indoor/Outdoor)
- **SV:** Soil Vapor

**Please print clearly, legally, and legibly. Samples can only be accepted for analysis if the form is completed in entirety. This form is subject to change.**

**INSTRUCTIONS**

1. **Date/Time**
2. **Received By:**
3. **Date/Time:**

Form No. 94-02 Rev. (06 Sep 15)

Langan Project No. 170684201
Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory’s Quality Assurance Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.10 LABORATORY SAMPLE STORAGE PROCEDURES

The subcontracted laboratory will use a laboratory information management system to track and schedule samples upon receipt by the analytical laboratories. Any sample anomalies identified during sample log-in must be evaluated on individual merit for the impact upon the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be immediately recorded. Each sample and container will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of all coolers and freezers will be monitored and recorded using a certified temperature sensor. Any temperature excursions outside of acceptance criteria (i.e., below 2°C or above 6°C) will initiate an investigation to determine whether any samples may have been affected. Samples for VOCs will be maintained in satellite storage areas within the VOC laboratory. Following analysis, the laboratory’s specific procedures for retention and disposal will be followed as specified in the laboratory’s SOPs and/or Quality Assurance Manual.

5.11 SPECIAL CONSIDERATIONS FOR PFAS SAMPLE COLLECTION

Soil and groundwater samples collected for analysis of PFAS will be collected in accordance with the specialized protocol outlined in this section. Soil and groundwater samples collected from select sample locations will be analyzed for 1,4-dioxane by EPA Method 8270 SIM, and for PFAS by EPA Method 1633 Modified in accordance with the procedure outlined in Attachment F.

The following special considerations apply to the collection of groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used
- No adhesives will be used
- No Sharpies or permanent markers will be used; ball point pens are acceptable
- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers
- Coolers will be filled only with regular ice

PFAS compound sampling protocols and laboratory SOP are provided in Attachment F.

### 5.12 PFAS TARGET ANALYTE LIST

DER has developed a PFAS target analyte list. At minimum, the laboratory will report the following PFAS target compounds:

<table>
<thead>
<tr>
<th>Group</th>
<th>Analyte Name</th>
<th>Abbreviation</th>
<th>CAS #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluoroalkyl carboxylates</td>
<td>Perfluorobutanoic acid</td>
<td>PFBA</td>
<td>375-22-4</td>
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<tr>
<td></td>
<td>Perfluoropentanoic acid</td>
<td>PFPeA</td>
<td>2706-90-3</td>
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<tr>
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<td>Perfluorohexanoic acid</td>
<td>PFHxA</td>
<td>307-24-4</td>
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<tr>
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<td>Perfluoroheptanoic acid</td>
<td>PFHpA</td>
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<td>Perfluorooctanoic acid</td>
<td>PFOA</td>
<td>335-67-1</td>
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<td></td>
<td>Perfluorononanoic acid</td>
<td>PFNA</td>
<td>375-95-1</td>
</tr>
<tr>
<td></td>
<td>Perfluorodecanoic acid</td>
<td>PFDA</td>
<td>335-76-2</td>
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<tr>
<td></td>
<td>Perfluoroundecanoic acid</td>
<td>PFUA/PFUdA</td>
<td>2058-94-8</td>
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<tr>
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<td>Perfluorododecanoic acid</td>
<td>PFDoA</td>
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<tr>
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<td>Perfluorotridecanoic acid</td>
<td>PFTrA/PFTeDA</td>
<td>72629-94-8</td>
</tr>
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<td>Perfluorotetradecanoic acid</td>
<td>PFTA/PFTeDA</td>
<td>376-06-7</td>
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<td>Perfluoroalkyl sulfonates</td>
<td>Perfluorobutanesulfonic acid</td>
<td>PFBS</td>
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<td>PFHxA</td>
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<td>6:2 FTS</td>
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<td>Fluorotelomer carboxylic acids</td>
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<td>5:3 FTCA</td>
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<td>NMefOSA</td>
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<td>NEtFOSA</td>
<td>4151-50-2</td>
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<td>N-MeFOSAA</td>
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<tr>
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<td>N-EtFOSAA</td>
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<td>N-methylperfluorooctane sulfonamidoethanol</td>
<td>MeFOSE</td>
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<td>Ether sulfonic acids</td>
<td>9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)</td>
<td>9Cl-PF3ONS</td>
<td>756426-58-1</td>
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<td>11-Chloroeicosfluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)</td>
<td>11Cl-PF3OUdS</td>
<td>763051-92-9</td>
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<tr>
<td></td>
<td>Perfluoro(2-ethoxyethane) sulfonic acid</td>
<td>PFEESA</td>
<td>113507-82-7</td>
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</tbody>
</table>
6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory quality assurance personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 methodology appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

6.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system. If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a quality control check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the quality assurance reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the quality assurance review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.
6.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA Region 2 SOPs for data validation and USEPA’s National Functional Guidelines for Organic and Inorganic Data Review. Tier 1 data validation (the equivalent of USEPA’s Stage 2A validation) will be performed to evaluate data quality. Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including:

- Holding times;
- Sample preservation;
- Blank results (method, trip, and field blanks);
- Surrogate recovery compounds and extracted internal standards (as applicable);
- LCS and LCSD recoveries and RPDs;
- MS and MSD recoveries and RPDs;
- Laboratory duplicate RPDs; and
- Field duplicate RPDs

A DUSR will be prepared by the data validator and reviewed by the Quality Assurance Manager before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- “U” - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- “UJ” - Not detected. Quantitation limit may be inaccurate or imprecise;
- “J” - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- “R” – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and
- No Flag - Result accepted without qualification.
7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the Quality Assurance Manager (QAM). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAM may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

7.2 SYSTEM AUDITS

System audits may be performed by the QAM or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. Additional audits may occur if conditions adverse to quality are detected or at the request of the Project Manager.

7.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

7.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the quality assurance group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management.
Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAM prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAM will close out the audit report and findings.
8.0 CORRECTIVE ACTION

8.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

8.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at a site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAM, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management personnel, field investigation teams, remedial response planning personnel, and laboratory groups monitor ongoing work performance during the normal course of daily responsibilities. Work may be audited at project sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.
Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 8.1 or similar by email). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the quality assurance personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The quality assurance personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated quality assurance personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.
Figure 8.1 Correction Action Request Form

<table>
<thead>
<tr>
<th>Corrective Action Request</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Number: ____________________</td>
<td>Date: ____________</td>
</tr>
<tr>
<td>TO: ______________________</td>
<td></td>
</tr>
<tr>
<td>You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by ____________</td>
<td></td>
</tr>
<tr>
<td>Condition:</td>
<td></td>
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<tr>
<td>Reference Documents:</td>
<td></td>
</tr>
<tr>
<td>Recommended Corrective Actions:</td>
<td></td>
</tr>
<tr>
<td>Originator Date Approval Date Approval Date</td>
<td></td>
</tr>
<tr>
<td>Response</td>
<td></td>
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<tr>
<td>Cause of Condition</td>
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<tr>
<td>Corrective Action</td>
<td></td>
</tr>
<tr>
<td>(A) Resolution</td>
<td></td>
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<tr>
<td>(B) Prevention</td>
<td></td>
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<tr>
<td>(C) Affected Documents</td>
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<tr>
<td>C.A. Followup:</td>
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</tr>
<tr>
<td>Corrective Action Verified By: ____________________ Date: ____________</td>
<td></td>
</tr>
</tbody>
</table>
9.0 REFERENCES


USEPA, 2016. Low/Medium Volatile Data Validation. SOP No. HW-33A, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2015. PCB Aroclor Data Validation. SOP No. HW-37A, Revision 0, dated July 2015. USEPA Region II.

USEPA, 2016. ICP-AES Data Validation. SOP No. HW-3a, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Mercury and Cyanide Data Validation. SOP No. HW-3c, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Pesticide Data Validation. SOP No. HW-36A, Revision 1, dated October 2016. USEPA Region II.

USEPA, 2016. Semivolatile Data Validation. SOP No. HW-35A, Revision 1, dated September 2016. USEPA Region II.

USEPA, 2016. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15, Revision 6, dated September 2016. USEPA Region II.


ATTACHMENT A

PROPOSED SAMPLING LOCATION PLAN
ATTACHMENT B

RESUMES
Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

SELECTED PROJECTS

- 227-14 North Conduit Avenue, Industrial Wastewater Compliance, Jamaica, NY
- 420 Kent Avenue, NYS Brownfield Cleanup Program, Brooklyn, NY
- 572 Eleventh Avenue, NYC VCP, New York, NY
- Monian Site A, OER E-Designated Site, New York, NY
- 537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
- ABC Blocks 25, 26 and 27, NYS Brownfield Cleanup Program Sites, Long Island City, NY
- 432 Rodney Street, NYS Brownfield Cleanup Program, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
- 787 Eleventh Avenue, NYS Brownfield Cleanup Program Site, New York, NY
- President Street at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 22-36 Second Avenue at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 563 Sacket Street, NYS Brownfield Cleanup Program Site, MGP Investigation, and Remediation, Brooklyn, NY
- 156-162 Perry Street, NYS Brownfield Cleanup Program Site, New York, NY
- Christopher and Weehawken Streets, NYS Brownfield Cleanup Program, New York, NY
- Phelps Dodge Block 2529 (Lots 40, 50, and 45), Inactive Hazardous Waste Disposal Site, Maspeth NY
- 42-50 24th Street, NYS Brownfield Cleanup Program Site, Long Island City, NY
- Storage Deluxe (163 6th Street), OER E-Designation Site, New York, NY

EDUCATION

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

Certified Hazardous Materials Manager – CHMM
No. 15998

LEED Accredited Professional (LEED AP)

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

AFFILIATIONS

New York State Council of Professional Geologists – Board of Directors
Prospect Park Redevelopment, Landfill Reclamation, Prospect Park, NJ
431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY
76 4th Street Property, Gowanus Due Diligence, Brooklyn, NY
Foxgate/MREC, Due Diligence and Solid Waste Compliance, Central Islip, NY
175-225 3rd Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
New York University Tandon School of Engineering, Spill Investigation/Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY
2420-2430 Amsterdam Avenue, NYS Brownfield Cleanup Program/Board of Standards and Appeals Variance, New York, NY
170 Amsterdam Avenue, NYC VCP, New York, NY
538-540 Hudson Street, NYS Brownfield Cleanup Program (Former Gas Station), New York, NY
234 Butler Street, Gowanus Canal Due Diligence, Brooklyn, NY
550 Clinton Street, NYS Brownfield Cleanup Program E-Designation, Brooklyn, NY
111 Leroy Street, OER E-Designation Site, New York, NY
335 Bond Street, NYS Brownfield Cleanup Program, New York, NY
Gowanus Canal Northside, NYS BCP Former Fuel Oil Terminal, Brooklyn, NY
Multiple Buildings, Major Oil Storage Facility, Gowanus Canal Location, Brooklyn, NY
197-205 Smith Street at Gowanus Canal, MGP Due Diligence, Brooklyn, NY
450 Union Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
86 Fleet Place, NYC VCP E-Designation, Brooklyn, NY
New York University College of Nursing at 433 1st Avenue, NYS BCP, Bronx, NY
Retail Building at 225 3rd Street, Brooklyn, NY
29-37 41st Avenue, NYS Brownfield Cleanup Program, Long Island City, NY
43-01 22nd Street, NYS Brownfield Cleanup Program, Long Island City, NY
Compliance Audit for NYU at Washington Square Park, New York, NY
Former Watermark Locations, NYS Brownfield Cleanup Program, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
Former Gas Station (1525 Bedford Avenue), Brooklyn, NY
NYS Brownfield Cleanup Program at 514 West 24th Street, New York, NY
Gowanus Canal Due Diligence at 76 4th Street, Brooklyn, NY
Urban Health Plan, Medical Building, NYS Brownfield Cleanup Program CVOC Investigation and Remediation, Bronx, NY
420 East 54th Street, NYS Spill Closure, New York, NY
Equity Residential at 160 Riverside Boulevard, NYS Spill Closure, New York, NY
357-359 West Street and 156 Leroy Street, NYC VCP, New York, NY
Emergency Spill Response at 322 West 57th Street, Investigation and Closure, New York, NY
MICHAEL D. BURKE, PG, CHMM, LEED AP

- Hurricane Sandy, Emergency Response at 21 West Street, New York, NY
- Hurricane Sandy, Emergency Response at 71 Pine Street, New York, NY
- Greenpoint Landing, NYC E-Designation, Brooklyn, NY
- 23-01 42nd Road, NYS Brownfield Cleanup Program, Long Island City, NY
- Greenpoint Waterfront Development, NYS Brownfield Cleanup Program, Brooklyn, NY
- 125th Street and Lenox Avenue, NYC VCP, New York, NY
- Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC, Investigation and Remediation, Brooklyn, NY
- SunCap Property Group Environmental On-Call Consulting, Various Locations, Nationwide
- Con Edison, Underground Storage Tank On-Call Contract, Five Boroughs of New York City, NY
- Con Edison, Construction Inspections On-Call Contract, Five Boroughs of New York City, NY
- Con Edison, Appendix B Spill Sites On-Call Contract, Five Boroughs of New York City, NY
- Meeker Avenue Plume Trackdown Site, Brooklyn, NY
- Distribution Facility, Superfund Redevelopment, Long Island City, NY
- Edison Properties, West 17th Street Development Site (Former MGP Site), New York, NY
- Con Edison, Governors Island Dielectric Fluid Spill, Investigation and Remediation, New York, NY
- 144-150 Barrow Street, NYS Brownfield Cleanup Program, New York, NY
- West 17th Street Development, NYS Brownfield Cleanup Program, MGP Investigation and Remediation, New York, NY
- Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
- New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
- NYCSCA, Proposed New York City School Construction Sites, Five Boroughs of New York City, NY
- Con Edison, East 60th Street Generating Station, New York, NY
- Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
- 1113 York Avenue, Storage Tank Closures, New York, NY
- Peter Cooper Village/Stuyvesant Town, Phase I ESA, New York, NY
- Superior Ink, Waste Characterization and Remedial Action Plans, New York, NY
- Bronx Mental Health Redevelopment Project, Phase I ESA, Bronx, NY
- 2950 Atlantic Avenue, Site Characterization Investigation, Brooklyn, NY
- Con Edison, East 74th Street Generating Station, Sediment Investigation, New York, NY
- Con Edison, First Avenue Properties, New York, NY
- Queens West Development Corp. Stage II, Long Island City, NY
- Article X Project Environmental Reviews, Various New York State Electrical Generation Sites, NY
- Poletti Generating Station, Astoria, NY
MICHAEL D. BURKE, PG, CHMM, LEED AP

- Arthur Kill Generating Station, Staten Island, NY
- Distribution Facility, Phase I & Phase II ESA and Regulatory Compliance, Bohemia, NY
- Huntington Station Superfund Due Diligence, Huntington Station, NY
- Garvies Point Bulkhead, Glen Cove, NY
- Johnson & Hoffman Metal Stamping Facility, Environmental Compliance, Carle Place, NY
- Floral Park Storage Facility, Phase I and Phase II ESA
- Garden City Phase I ESAs at two sites, including part of a Superfund Site, Garden City, NY
- Huntington Station Storage Facility, Phase I and II ESA, Huntington Station, NY
- Trevor Day School, NYS Spill Site Expert Testimony, New York, NY
- 320 West Fordham Road, Bronx, NY
- Bedford Union Armory, NYS Brownfield Cleanup Program, Brooklyn, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Burke, M., Ciambruschini, S., Nicholls, G., Tashji, A., Vaidya, S., “Redeveloping a Remediated MGP Site”, MGP Symposium 2019, Atlantic City, NJ.
Mr. Gochenaur is an environmental project manager with 20 years of experience in environmental due diligence, site investigation and remediation, fuel oil storage tank investigation and removal, soil vapor intrusion assessments, in-situ remedial technology, spill closure, vapor barrier and sub-slab depressurization system design and construction, emergency response, environmental and geotechnical site investigations, and health and safety monitoring. He has extensive experience with the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup, Voluntary Cleanup and Spill Programs and New York City Department of Environmental Protection (NYCDEP) “E” Designated and New York City Voluntary Cleanup Program (BCP) sites. His areas of expertise include Phase I Environmental Site Assessments, Phase II Site Investigations, and environmental consulting and oversight on large scale construction projects.

SELECTED PROJECTS

- 440 Washington Street, E-Designated services, New York, NY
- 3514 Surf Avenue, Tall Residential and Retail Building, Brooklyn, NY
- ARO 242 West 53, Tall Residential Building, New York, NY
- NY Aquarium Shark Exhibit, Soil Characterization and Excavation Oversight, Coney Island Neighborhood, Brooklyn, NY
- 60 West Street, Site Investigation and Redevelopment, Brooklyn, NY
- 535 4th Avenue, BCP Auto Repair Cleanup and Redevelopment, Brooklyn, NY
- 1525 Bedford Avenue, BCP Gas Station Cleanup and Redevelopment, Brooklyn, NY
- 220 Eleventh Avenue, Residential Building, New York, NY
- 432 Rodney Street, Residential Building, Brooklyn, NY
- 563 Sackett Street, Brooklyn, NY
- 362 West 125th Street, Residential Building, New York, NY
- Bedford Armory Redevelopment, Brooklyn, NY
- 268 West Street, BCP Redevelopment of Former Commercial and Industrial Site, New York, NY
- 110 125th Street, Soil Excavation and Remediation, New York, NY
- Former Roseland Ballroom Redevelopment, Soil Characterization and Excavation Oversight, New York, NY
- 42 Crosby Street, “E” Designated Site Investigation and Remediation, New York, NY
- New York School Construction Authority, Various Locations, In-House Environmental Consulting, Five Boroughs of New York City
- EZ Serve Portfolio, GE Capital, Various Phase II Site Investigations, FL, GA, LA, and MS
- Beth Elohim Child Daycare Center, Lead Based Paint Abatement, Brooklyn, NY
- Price Battery, Environmental Protection Agency (EPA) Lead Fallout Superfund Site, Hamburg, PA
BRIAN GOCHENAUR, QEP

- Clark Portfolio, GE Capital, Various Phase II Locations, MI, IL, ID, and OH
- Tops Plaza Portfolio, Prudential Real Estate Investors, Various Phase II Locations, NY
- Cingular Wireless Portfolio, Cingular Wireless, Various Locations Phase I and II Locations, WA
- Queens Center Mall Expansion, Remedial Oversight, Elmhurst, NY
- Soka Gakkai International-USA, Cultural Center, Brooklyn, NY
- 1752 Shore Parkway, Environmental Remediation, Brooklyn, NY
- Bedford Union Armory, NYS Brownfield Cleanup Program, Brooklyn, NY
- NYCEDC Manhattan Greenway – Harlem River, New York, NY
- 445 Gerard Avenue, Residential Building, Bronx, NY
Ms. Esmail is a civil and environmental engineer with four years of experience supporting environmental oversight and remediation projects in New York City. She has performed environmental field work including preparing daily inspection reports, photo documentation of work, and reviewing contractor submittals. She currently performs site research, manages field oversight, reviews/approves contractor submittals, prepares reports, and is involved with remedial design, implementation and project management.

Prior to joining Langan, Ms. Esmail gained three years of experience supporting environmental permitting and erosion and sedimentation control primarily for linear overhead transmission line projects. Types of permits included state land disturbance approvals and Army Corps of Engineers Section 10 Pre-Construction Notifications. Ms. Esmail also has experience aiding with the siting of new substation properties, using ArcGIS and AutoCAD to compile data for potential sites.

SELECTED PROJECTS

- Con Edison Partial Replacement of 345KV Feeders M51 & M52 Feasibility Study, New York, NY
- 220 Eleventh Avenue, Hudson Arts Building, New York, NY
- 50 Hudson Yards, Supertall Office Building, New York, NY
- 215 North 10th Street, Brooklyn, NY
- 320 West 135th Street, New York, NY
- 163 Varick Street, New York, NY
- 39 West 23rd Street, New York, NY
- 1 Huron Street, Brooklyn, NY
- Bedford Armory, Brooklyn, NY
- 1607 Surf Avenue, Brooklyn, NY
- 414 Gerard Avenue, Bronx, NY
- 445 Gerard Avenue, Bronx, NY
- 326-350 Rockaway Avenue, Brooklyn, NY
- 197-201 Canal Street, Staten Island, NY
- 475 Bay Street, Staten Island, NY
- Astoria Steel, Queens, NY
- 99 Hudson Boulevard, New York, NY
- 4650 Broadway, New York, NY
- 12-57 57th Street, Brooklyn, NY
- 805-825 Atlantic Avenue, Brooklyn, NY
- Various Phase I Environmental Site Assessments (ESAs) in NYC

EDUCATION

B.S., Civil Engineering (Environmental Concentration)
George Washington University

PROFESSIONAL REGISTRATION

Engineer in Training (EIT) in NC
Ms. Aronica is an environmental engineer with 3.5 years of experience in environmental engineering and remediation in New York and Tennessee. Ms. Aronica has experience in field investigation implementation and coordination, performing daily field inspections, photo documentation of work, leading tailgate safety talks, reviewing/approving contractor submittals, insuring contractors are in compliance with construction and remediation documents, reviewing subcontractor invoices, preparing regulatory reports, construction oversight, due diligence report writing, field implementations and senior engineer engineering support. Ms. Aronica is experienced in several computer design and drafting programs, including AutoCAD Civil 3D, and software such as Microsoft Word and Excel.

Her recent field experiences include performing monthly operation and maintenance inspections for a soil vapor extraction (SVE) system, performing quarterly sampling using a passive diffusion bag (PDB), performing a sub-membrane depressurization (SMD) system inspection, collection of field sampling, such as soil, groundwater, and soil vapor samples, and performing remedial oversight. Office responsibilities include regulatory report writing, writing Phase I Environmental Site Assessments (ESA), writing Final Engineering Reports and Site Management Plans (SMPs), field investigation coordination, and day-to-day construction oversight support.

**SELECTED PROJECTS**

- Con Edison Construction Inspections, Queens Feeder Enhancement, Queens, NY
- Astoria Steel, Construction Oversight and CAMP, Astoria, NY
- Bedford Armory, Construction Oversight and CAMP, Brooklyn, NY
- NYU CoGen Expansion, Construction Oversight, New York, NY
- Greenpoint Landing Block D, Construction Oversight, Brooklyn, NY
- 266 West 96th Street, Remedial Investigation and Construction Oversight, New York, NY
- 241 West 28th Street, Underground Storage Tank Closure, Construction Oversight, CAMP, New York, NY
- 2330 Broadway, Construction Oversight, Construction Oversight, New York, NY
- 320 West 31st Street, Remedial Investigation, New York, NY
- 475 Bay Street, Spill Delineation, Remedial Investigation, Underground Storage Tank Closure, Construction Oversight, SMP, FER, Staten Island, NY
- 1607 Surf Avenue, SMP and FER, Brooklyn, NY
- 805-825 Atlantic Avenue, Groundwater Sampling, Brooklyn, New York
- Bay Crane Sites, Remedial Investigation, Brooklyn, NY
Mr. Conboy has nine years of environmental chemistry, quality assurance, and environmental database management experience, with a current emphasis on validation of laboratory data for submittal to NJDEP via the New Jersey Data of Known Quality Protocols and to NYSDEC. Previous work experience includes performing validation of data for projects in USEPA Regions 2 and 3 while employing appropriate validation guidelines for each region, managing large data sets, updating appropriate regulatory limits, performing statistical evaluations, and preparing electronic data deliverables and report deliverables using the Earthsoft EQuIS database program, and acted as an intermediary between project managers, field staff, and laboratories. Mr. Conboy also has experience in field sampling techniques and maintains current OSHA HAZWOPER certification.

SELECTED PROJECTS

• 1400 Ferris, Bronx, NY – Completed validation of soil and groundwater data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOCs and SVOCs including 1,4-dioxane, and tangentially used based on professional judgment to perform validation of PFAS data.

• Broome Street Parking Lot, NY - Completed validation of waste characterization data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOCs, SVOCs, herbicides, PCBs, pesticides, metals including mercury, ignitability temperature, pH, reactive cyanide, reactive sulfide, cyanide, and hexavalent chromium. Toxicity characteristic leachate procedure extraction data for VOCs, SVOCs, herbicides, pesticides, metals, and mercury were also validated.

• 215 North 10th Street, Brooklyn, NY - Completed validation of soil and groundwater data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data.

• 35 Commercial Street, Brooklyn, NY - Completed validation of soil data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data, and tangentially used based on professional judgment to perform validation of PFAS data.

• Suffolk Street, Lower East Side, NY- Completed validation of soil, groundwater, and soil vapor data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II
guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, VOCs by USEPA TO-15, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data, and tangentially used based on professional judgment to perform validation of PFAS data.

- Managed a database for a confidential client containing 10+ years of environmental chemical data from multiple laboratories, requiring select data validation in accordance with New Jersey Data of Known Quality Protocols and identifying areas of delineation from historic field information. Once identified, NJDEP designated groundwater, surface water, soil, sediment, soil vapor, and custom screening criteria were researched and applied to each area, requiring individualized flagging for reporting.*

- Prepared the New Jersey Data of Known Quality Protocol Data Usability Evaluation and managed the database for a confidential client for a data set greater than 20 years old. A DUE or any validation effort was not prepared in the 20 years prior to current. This included data from variations of methods for volatile organic compounds, semivolatile organic compounds, total and dissolved metals, pesticides, herbicides, natural attenuation parameters, and per- and polyfluoroalkyl substances in multiple media.*

- Performed 200+ Stage 2a validations for a combined 87-acre USEPA designated Corrective Action site under the Resource Conservation and Recovery Act, including a quick-turn USEPA required PCB by soxhlet extraction investigation across multiple plants. Once a former train car painting facility, USEPA required a quick-turn PCB by soxhlet extraction soil investigation.

- Preparation of a quality assurance program for a confidential client in West Virginia. A quick turn QAPP was prepared in a service location new to the consultant, resulting in research into state requirements for data usability and auditing newly employed laboratories. The QAPP was understood to be prepared for groundwater only, but the client did not reveal the need for sediment and soil. Two QAPPs were submitted for review to governing agencies.*

- Used statistical software to determine a localized background upper confidence limit of chromium for a confidential client’s sand and gravel site. Validation was used to confirm laboratory procedures, and data was used in ProUCL calculations to compare to researched background chromium levels for Pennsylvania soils.*

- Prepared daily perimeter dust and air monitoring summaries and validation of low level mirex data for a confidential client’s superfund site. Low level mirex data was generated by university laboratories and subject to validation following national functional guidelines to aide in river clean-up, including sediment, surface water, and treatment system water matrices.*

*Project completed prior to employment at LANGAN.
ATTACHMENT C

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS
<table>
<thead>
<tr>
<th>Analyte</th>
<th>CAS #</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
<th>LCS Criteria</th>
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Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.
### TCL Volatiles - EPA 8260D/5035 High&Low (SOIL)

**Holding Time:** 14 days

**Container/Sample Preservation:** 1 - 1 Vial MeOH/2 Vial Water

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<tr>
<th>Analyte</th>
<th>CAS #</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
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<th>MS Criteria</th>
<th>MS RPD</th>
<th>Duplicate RPD</th>
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Please Note that the RL information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.

Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

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### Herbicides - EPA 8151A (SOIL)

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<td>81-117</td>
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<td>83-117</td>
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<td>Potassium, Total</td>
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<td>78-122</td>
<td>75-125</td>
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<td>180 days</td>
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<td>Silver, Total</td>
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<td>180 days</td>
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<td>Zinc, Total</td>
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Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.
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<thead>
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<th>MS Criteria</th>
<th>MS RPD</th>
<th>Duplicate RPD</th>
<th>Surrogate Criteria</th>
<th>Holding Time</th>
<th>Container</th>
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<td>28 days</td>
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<th>Duplicate RPD</th>
<th>Method</th>
<th>Holding Time</th>
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<td>Cyanide, Total</td>
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<th>MS RPD</th>
<th>Duplicate RPD</th>
<th>Surrogate Criteria</th>
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<tr>
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<td>378-52-4</td>
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<tr>
<td>Perfluorotetradecanoic Acid (PFTrDA)</td>
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<tr>
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<th>Duplicate RPD</th>
<th>Surrogate Criteria</th>
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ATTACHMENT B

GROUNDWATER SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS
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<td>Methylene chloride</td>
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Created By:
File:
Page:

Langan Engineering & Environmental

03/03/23
Ben Rao
PM14008-1
1

NYTCL Semivolatiles - EPA 8270E (LVI) (WATER)
Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 250ml unpreserved

Analyte
Acenaphthene
1,2,4-Trichlorobenzene
Hexachlorobenzene
Bis(2-chloroethyl)ether
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Fluoranthene
4-Chlorophenyl phenyl ether
4-Bromophenyl phenyl ether
Bis(2-chloroisopropyl)ether
Bis(2-chloroethoxy)methane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Isophorone
Naphthalene
Nitrobenzene
NitrosoDiPhenylAmine(NDPA)/DPA
n-Nitrosodi-n-propylamine
Bis(2-Ethylhexyl)phthalate
Butyl benzyl phthalate
Di-n-butylphthalate
Di-n-octylphthalate
Diethyl phthalate
Dimethyl phthalate
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Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
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Acenaphthylene
Anthracene
Benzo(ghi)perylene
Fluorene
Phenanthrene
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Indeno(1,2,3-cd)Pyrene

CAS #

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MDL

Units

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Duplicate
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Please Note that the RL information provided in this table is calculated using a 100% Solids factor. (Soil/Solids only)

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### TCL Pesticides - EPA 8081B (WATER)

**Holding Time:** 7 days

**Container/Sample Preservation:** 2 - Amber 120ml unpreserved

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<th>Surrogate Criteria</th>
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### TCL PCBs - EPA 8082A (LVI) (WATER)

#### Holding Time:
365 days

**Container/Sample Preservation:**
2 - Amber 120ml unpreserved

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<th>Duplicate RPD</th>
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<th>Holding Time</th>
<th>Container</th>
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<th>Container</th>
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1,4 Dioxane via EPA 8270E-SIM (WATER)

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## ATTACHMENT B

### AIR SAMPLES

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<td>Dichlorodifluoromethane</td>
<td>0.989 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Dichlorodifluoromethane</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Ethanol</td>
<td>9.42 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Ethanol</td>
<td>5 ppbV</td>
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</tr>
<tr>
<td>TO15</td>
<td>Ethyl Acetate</td>
<td>1.8 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Ethyl Acetate</td>
<td>0.5 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Ethylbenzene</td>
<td>0.869 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Ethylbenzene</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Freon-113</td>
<td>1.53 ug/m³</td>
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<td>TO15</td>
<td>Freon-113</td>
<td>0.2 ppbV</td>
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<tr>
<td>TO15</td>
<td>Freon-114</td>
<td>1.4 ug/m³</td>
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<td>Freon-114</td>
<td>0.2 ppbV</td>
<td>-</td>
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<tr>
<td>TO15</td>
<td>Heptane</td>
<td>0.82 ug/m³</td>
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<td>TO15</td>
<td>Heptane</td>
<td>0.2 ppbV</td>
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<td>TO15</td>
<td>Hexachlorobutadiene</td>
<td>2.13 ug/m³</td>
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<td>Hexachlorobutadiene</td>
<td>0.2 ppbV</td>
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<td>Isopropanol</td>
<td>1.23 ug/m³</td>
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<td>Isopropanol</td>
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<td>TO15</td>
<td>Methyl tert butyl ether</td>
<td>0.721 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Methyl tert butyl ether</td>
<td>0.2 ppbV</td>
<td>-</td>
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<tr>
<td>TO15</td>
<td>Methylene chloride</td>
<td>1.74 ug/m³</td>
<td>-</td>
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<td>Methylene chloride</td>
<td>0.5 ppbV</td>
<td>-</td>
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<td>TO15</td>
<td>n-Hexane</td>
<td>0.705 ug/m³</td>
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<td>TO15</td>
<td>n-Hexane</td>
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<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>o-Xylene</td>
<td>0.869 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>o-Xylene</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>p/m-Xylene</td>
<td>1.74 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>p/m-Xylene</td>
<td>0.4 ppbV</td>
<td>-</td>
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<tr>
<td>TO15</td>
<td>Styrene</td>
<td>0.852 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Styrene</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Tertiary butyl Alcohol</td>
<td>1.52 ug/m³</td>
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<td>TO15</td>
<td>Tertiary butyl Alcohol</td>
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<td>Tetrachloroethylene</td>
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<td>Tetrahydrofuran</td>
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<td>Tetrahydrofuran</td>
<td>0.5 ppbV</td>
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<td>Toluene</td>
<td>0.754 ug/m³</td>
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<td>TO15</td>
<td>trans-1,2-Dichloroethylene</td>
<td>0.793 ug/m³</td>
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<td>TO15</td>
<td>trans-1,2-Dichloroethylene</td>
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<tr>
<td>TO15</td>
<td>trans-1,3-Dichloropropene</td>
<td>0.908 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>trans-1,3-Dichloropropene</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Trichloroethylene</td>
<td>1.07 ug/m³</td>
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<td>TO15</td>
<td>Trichloroethylene</td>
<td>0.2 ppbV</td>
<td>-</td>
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<tr>
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<td>1.12 ug/m³</td>
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<td>TO15</td>
<td>Trichlorofluoromethane</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Vinyl bromide</td>
<td>0.874 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Vinyl bromide</td>
<td>0.2 ppbV</td>
<td>-</td>
</tr>
<tr>
<td>TO15</td>
<td>Vinyl chloride</td>
<td>0.511 ug/m³</td>
<td>-</td>
<td>TO15</td>
<td>Vinyl chloride</td>
<td>0.2 ppbV</td>
<td>-</td>
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</table>
ATTACHMENT D

ANALYTICAL METHODS/
QUALITY ASSURANCE SUMMARY TABLE
<table>
<thead>
<tr>
<th>Matrix Type</th>
<th>Field Parameters</th>
<th>Laboratory Parameters</th>
<th>Analytical Methods</th>
<th>Sample Container Volume and Type</th>
<th>Sample Hold Time</th>
<th>Field Duplicate Samples</th>
<th>Field Blank Samples</th>
<th>Media Blank Samples</th>
<th>Top Blank Samples</th>
<th>Trip Blank Samples</th>
<th>Ambient Air Samples</th>
<th>MEL/NOSE Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>Total VOCs via RIO</td>
<td>2.7-Liter Summa Canister</td>
<td>NA</td>
<td>1 per 20 samples (minimum 1)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1 per 20 samples</td>
</tr>
<tr>
<td></td>
<td>Groundwater</td>
<td>1 per 20 samples (minimum 1)</td>
<td>Total VOCs via PID</td>
<td>Soil Vapor</td>
<td>Total VOCs, Oxygen, LEL, CO, and H2S, with Standard Meters</td>
<td>2.5-Liter Summa Canister</td>
<td>1 per 20 samples (minimum 1)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1 per 40 samples (minimum 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matrix Type</td>
<td>Field Parameters</td>
<td>Laboratory Parameters</td>
<td>Analytical Methods</td>
<td>Sample Preservation</td>
<td>Sample Container Volume and Type</td>
<td>Sample Hold Time</td>
<td>Field Duplicate Samples</td>
<td>Field Blank Samples</td>
<td>Media Blank Samples</td>
<td>Equipment Blank Samples</td>
<td>Trip Blank Samples</td>
<td>Ambient Air Samples</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------</td>
<td>-----------------------</td>
<td>--------------------</td>
<td>---------------------</td>
<td>-------------------------------</td>
<td>------------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Soil Vapor</td>
<td>Mercury Vapor via James 2009</td>
<td>£PA 8089</td>
<td>Ambient Temperature</td>
<td>Glass Containing Tube containing one section of 200 mg Hopcalite</td>
<td>Amount within 30 days of collection</td>
<td>per 30 samples</td>
<td>1 per set</td>
<td>NA</td>
<td>NA</td>
<td>3 per set</td>
<td>NA</td>
<td>per 10 samples</td>
</tr>
</tbody>
</table>

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. EPA - Environmental Protection Agency
4. TCL - Target compound list
5. TAL - Target analyte list
6. ORP - Oxidation reduction potential
7. DO - Dissolved oxygen
8. LEL - Lower explosive limit
9. CO - Carbon monoxide
10. H2S - Hydrogen sulfide
11. PFAS - Perfluoroalkyl substances
12. HDPE - High-Density Polyethylene
ATTACHMENT E

SAMPLE NOMENCLATURE STANDARD OPERATING PROCEDURE
INTRODUCTION

The Langan Environmental Group conducts an assortment of site investigations where samples (Vapor, Solids, and Aqueous) are collected and submitted to analytical laboratories for analysis. The results of which are then evaluated and entered into a data base allowing quick submittal to the state regulatory authority (New York State Division of Environmental Conservation [NYSDEC]). In addition, Langan is linking their data management system to graphic and analytical software to enable efficient evaluation of the data as well as creating client-ready presentational material.

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the general framework for labeling vapor, solid (soil) and aqueous (groundwater) samples that will be submitted for laboratory analysis. The nomenclature being introduced is designed to meet the NYSDEC EQuIS standard and has been incorporated into Langan software scripts to assist project personnel in processing the data. While this SOP is applicable to all site investigation; unanticipated conditions may arise which may require considerable flexibility in complying with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied; but deviation from this SOP must be reported to the Project Manager (PM) immediately.

GENERAL SAMPLE IDENTIFICATION CONSIDERATIONS

Sample Labels
All sample ware must have a label. Recall that when you are using the Encore™ samples (see below); they are delivered in plastic lined foil bags. You are to label the bags:

All other samples containers including Terra Cores™ must be labeled with laboratory provided self-adhesive labels.

Quick Breakdown of Sample Format
The general format for sample nomenclature is:

1Both Alpha and York laboratories permit the combining of the three Encore™ into a single bag. This may not be appropriate for all laboratories so please confirm with the labs themselves
LLNN_ID

Where

**LL** is a grouping of two (2) to four (4) letters signifying the sample media source. In older nomenclature SOPs this portion of the sample identification is commonly referred to as the *Sample Investigation Code*

**NN** represents a two digit number identifying the specific sample location or sample sequence number

_ (underscore) is required between the sample lettering and numeric identification and additional modifying data that determines the date of sampling or the depth of the sample interval

**ID** is a modifier specific to the sample type media (depth of soil sample or date of groundwater sample)

**LL - Sample Investigation Code**

Langan has devised a list of two to four letters to insure a quick ability to identify the sample investigation.

<table>
<thead>
<tr>
<th>Code</th>
<th>Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Ambient Air</td>
</tr>
<tr>
<td>DS</td>
<td>Drum</td>
</tr>
<tr>
<td>EPB</td>
<td>Endpoint Location - Bottom (Excavation)</td>
</tr>
<tr>
<td>EPSW</td>
<td>Endpoint Location - Sidewall (Excavation)</td>
</tr>
<tr>
<td>FP</td>
<td>Free Product</td>
</tr>
<tr>
<td>IA</td>
<td>Indoor Air</td>
</tr>
<tr>
<td>IDW</td>
<td>Investigation Derived Waste (Soil Pile)</td>
</tr>
<tr>
<td>MW</td>
<td>Monitoring Well (Permanent)</td>
</tr>
<tr>
<td>SB</td>
<td>Soil Boring</td>
</tr>
<tr>
<td>SG</td>
<td>Staff Gauge (Stream Gauging)</td>
</tr>
<tr>
<td>SL</td>
<td>Sludge</td>
</tr>
<tr>
<td>SV</td>
<td>Soil Vapor Point</td>
</tr>
<tr>
<td>SVE</td>
<td>Soil Vapor Extraction Well</td>
</tr>
<tr>
<td>SW</td>
<td>Surface Water</td>
</tr>
<tr>
<td>TMW</td>
<td>Temporary Monitoring Well</td>
</tr>
<tr>
<td>TP</td>
<td>Test Pit (Excavated Material from Test Pit Not Associated With Sidewall or Bottom Samples)</td>
</tr>
<tr>
<td>WC</td>
<td>Waste Characterization Boring</td>
</tr>
<tr>
<td>COMP</td>
<td>Composite Sample</td>
</tr>
<tr>
<td>TB</td>
<td>Trip Blank (QA/QC Sampling – All Investigations)</td>
</tr>
<tr>
<td>FB</td>
<td>Field Blank (QA/QC Sampling – All Investigations)</td>
</tr>
<tr>
<td>DUP</td>
<td>Duplicate (QA/QC Sampling – All Investigations)</td>
</tr>
</tbody>
</table>

**NN - Numeric Identifier**

The two digit number that follows the sample investigation code (LL) identifies the specific sample based on the soil boring, monitoring well, endpoint or other location identification. For a subset of samples
where there is no specific location identifier, the two digit number is the sequence number for the sample submitted. For example, an aqueous sample from a monitoring well identified as MW-1 would have the sample investigation code of MW and the numeric identifier as 01. Note there is no hyphen. The same can be done for soil borings, a soil sample collected from soil boring 9 (SB-9) would be have the LLNN identification of SB09 (again, no hyphen).

Note however that there is a subset of samples related to laboratory analytical quality assurance, among these includes TB, FB, and DUP. On many investigations, the Scope will require multiple collections of these types of samples, therefore the numerical number represents the sequence sample count where the first sample is 01, the second sample is 02, and the third sample is 03 and so on.

_ Underscore_

The underscore is required. It separates the investigation code and numeric identifier from the modifier specific to the sample itself. Note that every effort should be made to insure that the underscore is clear on the sample label and chain of custody (COC).

**ID – Modifier Specific to Type Media**

Each sample investigation code and numeric identifier is further modified by an ID specific to the sample type media. In general, soil samples (soil borings or endpoint samples) use an ID that indicates the depth at which the sample was taken. Aqueous samples (groundwater or surface water samples) are identified by the date the sample was collected. Other types of samples including quality control (TB, FB, and DUP), Vapor samples (AA, IA, SV or SVE), other soil type samples (IDW, sludge, free product, drum, and others) are also identified by a date. The following rules apply to the ID when using sample depth or sample date.

*Sample Depth*

The sample depth must be whole numbers (no fractions) separated by a hyphen. Thus for a soil sample collected from the soil boring SB-1 from a depth of 6 feet to 8 feet, the sample would be identified as:

```
SB01_6-8
```

Unfortunately, the NYSDEC EQuIS system does not accept fractions. Therefore, if your sample interval is a fraction of a foot (6.5-7.5), round up to the larger interval (6-8).

*Sample Date*

The sample date is always in the format of MMDDYY. Note that the year is two digits. Thus for a groundwater sample collected on July 1, 2015 from the monitoring well MW-1, the sample would be identified as:

```
MW01_070115
```

**Special Cases**

There are a couple of specific sample types that require further explanation.

*Endpoint Sampling*

End point sidewall samples are sometimes modified by magnetic direction (N, S, E, and W). For example, the first sidewall endpoint sample from the north wall of an excavation at a depth of 5 feet would be written as:

```
EPSW01_N_5
```
Again, note that the N in the identification refers to north and is separated from the prefix investigation code/numeric identifier and ID modifier suffix by underscores.

**Vapor Extraction Well Sample**

As with the sidewall endpoint samples, the sample name is altered by inserting a middle modifier between the prefix and suffix of the sample name. The middle modifier is used to identify the source of the sample (inlet sample port, midpoint sample port or outlet sample port). For example the midpoint port of the vapor extraction well number 1 sampled on July 1, 2015 would be written as;

SVE01_MID_070115

**Matrix Spike and Matrix Spike Duplicate**

On occasion, a Langan investigation will collect a sample to be used to provide the lab with a site specific medium to spike to determine the quality of the analytical method. This special case of sampling requires additional information to be used in the sample name, specifically, a suffix specifying whether the sample is the matrix spike (MS) or the matrix spike duplicate (MSD). In the following example, the sample is collected from soil boring number 1 at a depth of 2-4 feet. For the matrix spike sample:

SB01_2-4_MS

and for the matrix spike duplicate sample:

SB01_2-4_MSD

**Multiple Interval Groundwater Sampling**

Although not currently a common practice, low flow sampling facilitates stratigraphic sampling of a monitoring well. If the scope requires stratigraphic sampling then groundwater samples will be labeled with a lower case letter following the well number. For example, placing the pump or sampling tube at 10 feet below surface in MW01 on July 1, 2015 would require the sample to be labeled as:

MW01a_070115

While a second sample where the pump or tubing intake is placed at 20 feet would be labeled as:

MW01b_070115

Note that it is important that you record what depth the intake for each sample represents in your field notes; as this information is going to be critical to interpreting the results.
ATTACHMENT F

PFAS SAMPLING PROTOCOL AND
LABORATORY SOP
SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC’s Part 375 Remedial Programs

April 2023
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### Citation and Page Number | Current Text | Corrected Text | Date
---|---|---|---
Title of Appendix I, page 32 | Appendix H | Appendix I | 2/25/2020
Document Cover, page 1 | Guidelines for Sampling and Analysis of PFAS | Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC’s Part 375 Remedial Programs | 9/15/2020
Data Assessment and Application to Site Cleanup Page 3 | Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published | Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published | 3/28/2023
Water Sample Results Page 3 | PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below. | NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below. | 3/28/2023
Soil Sample Results Page 3 | Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values: | NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values: | 3/28/2023
Protection of Groundwater Page 3 | PFOA (ppb) 1.1 PFOS (ppb) 3.7 | PFOA (ppb) 0.8 PFOS (ppb) 1.0 | 3/28/2023
<table>
<thead>
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<th>Citation and Page Number</th>
<th>Current Text</th>
<th>Corrected Text</th>
<th>Date</th>
</tr>
</thead>
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<tr>
<td>Footnote 2 Page 3</td>
<td>The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (<a href="http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf">http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf</a>).</td>
<td>The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (<a href="https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf">https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf</a>). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (<a href="http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf">http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf</a>).</td>
<td>3/28/2023</td>
</tr>
</tbody>
</table>

| Testing for Imported Soil Page 4 | If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. | If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable. | 3/28/2023 |

| Routine Analysis, page 9 | “However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533.” | “However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533.” | 9/15/2020 |

<p>| Additional Analysis, page 9, new paragraph regarding soil parameters | None | “In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.” | 9/15/2020 |</p>
<table>
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<th>Current Text</th>
<th>Corrected Text</th>
<th>Date</th>
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</thead>
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<tr>
<td>Data Assessment and Application to Site Cleanup Page 10</td>
<td>Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.</td>
<td>Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.</td>
<td>9/15/2020</td>
</tr>
<tr>
<td>Water Sample Results Page 10</td>
<td>PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.</td>
<td>PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.</td>
<td>9/15/2020</td>
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<td>Citation and Page Number</td>
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</tr>
<tr>
<td>Soil Sample Results, page 10</td>
<td>“The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.”</td>
<td>“Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. “</td>
<td>9/15/2020</td>
</tr>
</tbody>
</table>

[Interim SCO Table]
“PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: [https://www.nj.gov/dep/srp/guidance/rs/daf.pdf](https://www.nj.gov/dep/srp/guidance/rs/daf.pdf).”
<table>
<thead>
<tr>
<th>Citation and Page Number</th>
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<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing for Imported Soil Page 11</td>
<td>Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State’s Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.</td>
<td>Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.</td>
<td>9/15/2020</td>
</tr>
<tr>
<td>Citation and Page Number</td>
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<tr>
<td>Footnotes</td>
<td>None</td>
<td>¹ TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. ² The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (<a href="http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf">http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf</a>).</td>
<td>9/15/2020</td>
</tr>
<tr>
<td>Additional Analysis, page 9</td>
<td>In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…</td>
<td>In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…</td>
<td>1/8/2021</td>
</tr>
<tr>
<td>Appendix A, General Guidelines, fourth bullet</td>
<td>List the ELAP-approved lab(s) to be used for analysis of samples</td>
<td>List the ELAP-certified lab(s) to be used for analysis of samples</td>
<td>1/8/2021</td>
</tr>
<tr>
<td>Appendix E, Laboratory Analysis and Containers</td>
<td>Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.</td>
<td>Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101</td>
<td>1/8/2021</td>
</tr>
<tr>
<td>Water Sample Results Page 9</td>
<td>“In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L”</td>
<td>Deleted</td>
<td>6/15/2021</td>
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<tr>
<td>Citation and Page Number</td>
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</tr>
<tr>
<td>Routine Analysis, Page XX</td>
<td>Currently, New York State Department of Health’s Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER’s laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).</td>
<td>Deleted</td>
<td>5/31/2022</td>
</tr>
<tr>
<td>Analysis and Reporting, Page XX</td>
<td>As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.</td>
<td>Deleted</td>
<td>5/31/2022</td>
</tr>
<tr>
<td>Routine Analysis, Page XX</td>
<td>LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.</td>
<td>EPA Method 1633 is the procedure to use for environmental samples.</td>
<td></td>
</tr>
<tr>
<td>Soil Sample Results, Page XX</td>
<td>Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6</td>
<td>Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6</td>
<td></td>
</tr>
<tr>
<td>Appendix A</td>
<td>“Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1”</td>
<td>“Include in the text ….EPA Method 1633”</td>
<td></td>
</tr>
<tr>
<td>Appendix A</td>
<td>“Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101”</td>
<td>Deleted</td>
<td></td>
</tr>
<tr>
<td>Appendix B</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”</td>
<td></td>
</tr>
<tr>
<td>Citation and Page Number</td>
<td>Current Text</td>
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<tr>
<td>Appendix C</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”</td>
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</tr>
<tr>
<td>Appendix D</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1”</td>
<td>“Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633”</td>
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<tr>
<td>Appendix G</td>
<td></td>
<td>Updated to include all forty PFAS analytes in EPA Method 533</td>
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<tr>
<td>Appendix H</td>
<td></td>
<td>Appendix I</td>
<td></td>
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<tr>
<td>Appendix I</td>
<td>Appendix I</td>
<td>Appendix H</td>
<td></td>
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<tr>
<td>Appendix H</td>
<td>“These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report.”</td>
<td>“These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER).”</td>
<td></td>
</tr>
<tr>
<td>Appendix H</td>
<td>“The holding time is 14 days…”</td>
<td>“The holding time is 28 days…”</td>
<td></td>
</tr>
<tr>
<td>Appendix H, Initial Calibration</td>
<td>“The initial calibration should contain a minimum of five standards for linear fit…”</td>
<td>“The initial calibration should contain a minimum of six standards for linear fit…”</td>
<td></td>
</tr>
<tr>
<td>Appendix H, Initial Calibration</td>
<td>Linear fit calibration curves should have an R² value greater than 0.990.</td>
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<tr>
<td>Appendix H, Initial Calibration Verification Section</td>
<td>Initial Calibration Verification Section</td>
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<tr>
<td>Appendix H</td>
<td>secondary Ion Monitoring Section</td>
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<tr>
<td>Appendix H</td>
<td>Branch and Linear Isomers Section</td>
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Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC’s Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation’s Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER’s remedial programs. Given the prevalence and use of PFAS, DER has developed “best management practices” specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.
Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a PFAS Analyte List (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the PFAS Analyte List may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire PFAS Analyte List, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.1

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1 TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.
Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA’s Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

<table>
<thead>
<tr>
<th>Guidance Values for Anticipated Site Use</th>
<th>PFOA (ppb)</th>
<th>PFOS (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted</td>
<td>0.66</td>
<td>0.88</td>
</tr>
<tr>
<td>Residential</td>
<td>6.6</td>
<td>8.8</td>
</tr>
<tr>
<td>Restricted Residential</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>Commercial</td>
<td>500</td>
<td>440</td>
</tr>
<tr>
<td>Industrial</td>
<td>600</td>
<td>440</td>
</tr>
</tbody>
</table>

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

2 The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).
additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.)
and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives
for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil
pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange
capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution
attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference:

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS
should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the
guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER
based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the
ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate
for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should
be submitted for backfill samples, though a DUSR is not required.
Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
  - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
  - Matrix type
  - Number or frequency of samples to be collected per matrix
  - Number of field and trip blanks per matrix
  - Analytical parameters to be measured per matrix
  - Analytical methods to be used per matrix with minimum reporting limits
  - Number and type of matrix spike and matrix spike duplicate samples to be collected
  - Number and type of duplicate samples to be collected
  - Sample preservation to be used per analytical method and sample matrix
  - Sample container volume and type to be used per analytical method and sample matrix
  - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (PFAS Analyte List)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
  - Reporting Limits should be less than or equal to:
    - Aqueous – 2 ng/L (ppt)
    - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Include detailed sampling procedures
  - Precautions to be taken
  - Pump and equipment types
  - Decontamination procedures
  - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix
Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.
Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.
Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.
Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.
Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).
Quality Assurance/Quality Control

• Immediately place samples in a cooler maintained at 4 ± 2°C Celsius using ice
• Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
• Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
• Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
• Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.
Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).
Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2°C Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.
Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector.

**Procedure Name:** General Fish Handling Procedures for Contaminant Analysis

**Number:** FW-005

**Purpose:** This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

**Organization:** Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

**Version:** 8

**Previous Version Date:** 21 March 2018

**Summary of Changes to this Version:** Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

**Originator or Revised by:** Wayne Richter, Jesse Becker

**Date:** 26 April 2019

**Quality Assurance Officer and Approval Date:** Jesse Becker, 26 April 2019
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

1. The top box is to be filled out and signed by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

2. The second section is to be filled out and signed by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the range of identification numbers (i.e., tag numbers) included in the sample batch.

3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be identified, signed, and dated, until laboratory personnel take possession of the fish.

B. The following data are required on each Fish Collection Record form:

1. Project and Site Name.

2. DEC Region.

3. All personnel (and affiliation) involved in the collection.

4. Method of collection (gill net, hook and line, etc.)

5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the Fish Collection Record form:

1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

3. Date collected.

4. Sample location (waterway and nearest prominent identifiable landmark).

5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or...
smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. The Bureau of Ecosystem Health will supply the bags. If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with
the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges.** Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:
   - No materials containing Teflon.
   - No Post-it notes.
   - No ice packs; only water ice or dry ice.
   - Any gloves worn must be powder free nitrile.
   - No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
   - No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
   - Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
   - Wash hands after handling any food containers or packages as these may contain PFCs.
   - Keep pre-wrapped food containers and wrappers isolated from fish handling.
   - Wear clothing washed at least six times since purchase.
   - Wear clothing washed without fabric softener.
   - Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.
Project and Site Name ____________________________________________ DEC Region _____________

Collections made by (include all crew) _____________________________________________

Sampling Method: ☐ Electrofishing ☐ Gill netting ☐ Trap netting ☐ Trawling ☐ Seining ☐ Angling ☐ Other ________________________________

Preservation Method: ☐ Freezing ☐ Other ____________________________ Notes (SWFDB survey number): ____________________________________

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
CHAIN OF CUSTODY

I, _____________________________, of ___________________________________________ collected the
(Print Name) (Print Business Address)
following on ___________________, 20____ from ____________________________________________
(Date) (Water Body)
in the vicinity of ________________________________________________________________________
(Landmark, Village, Road, etc.)
Town of ______________________________________, in ________________________________ County.

Item(s) ________________________________________________________________________________
_______________________________________________________________________________________

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to
collection. The sample(s) were placed in the custody of a representative of the New York State Department of
Environmental Conservation on ___________________________________, 20______.

_____________________________ __________________________
Signature Date

I, _________________________________, received the above mentioned sample(s) on the date specified
and assigned identification number(s) ______________________________________ to the sample(s). I
have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in
my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____________________________ __________________________
Signature Date

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richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019
NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.
EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelopes, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.
## Appendix G – PFAS Analyte List

<table>
<thead>
<tr>
<th>Group</th>
<th>Chemical Name</th>
<th>Abbreviation</th>
<th>CAS Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perfluoroalkyl sulfonic acids</strong></td>
<td>Perfluorobutanesulfonic acid</td>
<td>PFBS</td>
<td>375-73-5</td>
</tr>
<tr>
<td></td>
<td>Perfluoropentanesulfonic acid</td>
<td>PFPeS</td>
<td>2706-91-4</td>
</tr>
<tr>
<td></td>
<td>Perfluorohexanesulfonic acid</td>
<td>PFHxS</td>
<td>355-46-4</td>
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<td></td>
<td>Perfluoroheptanesulfonic acid</td>
<td>PFHpS</td>
<td>375-92-8</td>
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<td>Perfluoroctanesulfonic acid</td>
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<td></td>
<td>Perfluorononanesulfonic acid</td>
<td>PFNS</td>
<td>68259-12-1</td>
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<td></td>
<td>Perfluorodecanesulfonic acid</td>
<td>PFDS</td>
<td>335-77-3</td>
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<td>Perfluorododecanesulfonic acid</td>
<td>PFDoS</td>
<td>79780-39-5</td>
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<tr>
<td><strong>Perfluoroalkyl carboxylic acids</strong></td>
<td>Perfluorobutanoic acid</td>
<td>PFBA</td>
<td>375-22-4</td>
</tr>
<tr>
<td></td>
<td>Perfluoropentanoic acid</td>
<td>PFPeA</td>
<td>2706-90-3</td>
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<tr>
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<td>Perfluorohexanoic acid</td>
<td>PFHxA</td>
<td>307-24-4</td>
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<td>Perfluoroheptanoic acid</td>
<td>PFHpA</td>
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<td>Perfluorooctanoic acid</td>
<td>PFOA</td>
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<td>Perfluorononanoic acid</td>
<td>PFNA</td>
<td>375-95-1</td>
</tr>
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<td>Perfluorodecanoic acid</td>
<td>PFDA</td>
<td>335-76-2</td>
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<tr>
<td></td>
<td>Perfluoroundecanoic acid</td>
<td>PFUnA</td>
<td>2058-94-8</td>
</tr>
<tr>
<td></td>
<td>Perfluorododecanoic acid</td>
<td>PFDoA</td>
<td>307-55-1</td>
</tr>
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<td></td>
<td>Perfluorotridecanoic acid</td>
<td>PFTrDA</td>
<td>72629-94-8</td>
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<tr>
<td></td>
<td>Perfluorotetra decanoic acid</td>
<td>PFTeDA</td>
<td>376-06-7</td>
</tr>
<tr>
<td><strong>Per- and Polyfluoroether carboxylic acids</strong></td>
<td>Hexafluoropropylene oxide dimer acid</td>
<td>HFPO-DA</td>
<td>13252-13-6</td>
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<tr>
<td></td>
<td>4,8-Dioxa-3H-perfluorononanoic acid</td>
<td>ADONA</td>
<td>919005-14-4</td>
</tr>
<tr>
<td></td>
<td>Perfluoro-3-methoxypropanoic acid</td>
<td>PFMPA</td>
<td>377-73-1</td>
</tr>
<tr>
<td></td>
<td>Perfluoro-4-methoxybutanoic acid</td>
<td>PFMBDA</td>
<td>863090-89-5</td>
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<td>Nonafluoro-3,6-dioxaheptanoic acid</td>
<td>NFDHA</td>
<td>151772-58-6</td>
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<tr>
<td><strong>Fluorotelomer sulfonic acids</strong></td>
<td>4:2 Fluorotelomer sulfonic acid</td>
<td>4:2-FTS</td>
<td>757124-72-4</td>
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<td>6:2 Fluorotelomer sulfonic acid</td>
<td>6:2-FTS</td>
<td>27619-97-2</td>
</tr>
<tr>
<td></td>
<td>8:2 Fluorotelomer sulfonic acid</td>
<td>8:2-FTS</td>
<td>39108-34-4</td>
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<td><strong>Fluorotelomer carboxylic acids</strong></td>
<td>3:3 Fluorotelomer carboxylic acid</td>
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<td>5:3 Fluorotelomer carboxylic acid</td>
<td>5:3 FTCA</td>
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<td></td>
<td>7:3 Fluorotelomer carboxylic acid</td>
<td>7:3 FTCA</td>
<td>812-70-4</td>
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<tr>
<td><strong>Perfluoroctane sulfonamides</strong></td>
<td>Perfluoroctane sulfonamide</td>
<td>PFOASA</td>
<td>754-91-6</td>
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<td></td>
<td>N-methyl/perfluoroctane sulfonamide</td>
<td>NMefOSA</td>
<td>31506-32-8</td>
</tr>
<tr>
<td></td>
<td>N-ethyl/perfluoroctane sulfonamide</td>
<td>NEfOSA</td>
<td>4151-50-2</td>
</tr>
<tr>
<td><strong>Perfluoroctane sulfonamidoacetic acids</strong></td>
<td>N-methyl/perfluoroctane sulfonamidoacetic acid</td>
<td>N-MefOSAA</td>
<td>2355-31-9</td>
</tr>
<tr>
<td></td>
<td>N-ethyl/perfluoroctane sulfonamidoacetic acid</td>
<td>N-EfOSAA</td>
<td>2991-50-6</td>
</tr>
<tr>
<td><strong>Perfluoroctane sulfonamide ethanol</strong></td>
<td>N-methyl/perfluoroctane sulfonamidoethanol</td>
<td>MeFOSE</td>
<td>24448-09-7</td>
</tr>
<tr>
<td></td>
<td>N-ethyl/perfluoroctane sulfonamidoethanol</td>
<td>EfOSA</td>
<td>1691-99-2</td>
</tr>
<tr>
<td>Group</td>
<td>Chemical Name</td>
<td>Abbreviation</td>
<td>CAS Number</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>Ether sulfonic acids</td>
<td>9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)</td>
<td>9Cl-PF3ONS</td>
<td>756426-58-1</td>
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<tr>
<td></td>
<td>11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)</td>
<td>11Cl-PF3OUdS</td>
<td>763051-92-9</td>
</tr>
<tr>
<td></td>
<td>Perfluoro(2-ethoxyethane) sulfonic acid</td>
<td>PFEESA</td>
<td>113507-82-7</td>
</tr>
</tbody>
</table>
Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General
These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory’s Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER’s Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time
Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

<table>
<thead>
<tr>
<th>Temperature greatly exceeds 6°C upon arrival at the lab*</th>
<th>Use professional judgement to qualify detects and non-detects as estimated or rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holding time exceeding 28 days to extraction</td>
<td>Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded</td>
</tr>
</tbody>
</table>

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration
The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

| %RSD >20% | J flag detects and UJ non detects |

Continuing Calibration Verification
Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

| CCV recovery <70 or >130% | J flag results |
There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

<table>
<thead>
<tr>
<th>Blank Result</th>
<th>Sample Result</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any detection</td>
<td>&lt;Reporting limit</td>
<td>Qualify as ND at reporting limit</td>
</tr>
<tr>
<td>Any detection</td>
<td>&gt;Reporting Limit and &gt;10x the blank result</td>
<td>No qualification</td>
</tr>
<tr>
<td>&gt;Reporting limit</td>
<td>&gt;Reporting limit and &lt;10x blank result</td>
<td>J+ biased high</td>
</tr>
</tbody>
</table>

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

| RPD >30% | Apply J qualifier to parent sample |

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

| Recovery <70% or >130% (lab derived criteria can also be used) | Apply J qualifier to detects and UJ qualifier to non detects |

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

| Recovery <70% or >130% (lab derived criteria can also be used) | Apply J qualifier to detects and UJ qualifier to non detects of parent sample only |
| RPD >30% | Apply J qualifier to detects and UJ qualifier to non detects of parent sample only |

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

| Recovery <50% or >150% | Apply J qualifier |
| Recovery <25% or >150% for poor responding analytes | Apply J qualifier |
| Isotope Dilution Analyte (IDA) Recovery <10% | Reject results |
Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.
Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS

References: Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, Oil and Tissue Samples by LC-MS/MS (2nd Draft - June 2022)


1. Scope and Application

Matrices: Drinking water, Non-potable Water, Tissues, Oils, Biosolids and Solid Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 Method 1633 is for use in the Clean Water Act (CWA) for the determination of the per- and polyfluoroalkyl substances (PFAS) in Table 1 in aqueous, solid (soil, biosolids, sediment) and tissue samples by liquid chromatography/mass spectrometry (LC-MS/MS).

1.2 The method calibrates and quantifies PFAS analytes using isotopically labeled standards. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations.

1.3 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water, tissue soil and biosolid Matrices. Accuracy and precision data have been generated for the compounds listed in Table 1.

1.4 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or
extracted internal standard quantification using isotopically labeled compounds added to the samples before extraction.

2.2 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

2.3 Solid and Oil samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.4 Tissue samples are spiked with isotopically labeled standards, extracted in potassium hydroxide and acetonitrile followed by basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.5 A sample extract is injected into an LC equipped with a C18 column that is interfaced to an MS/MS). The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.6 Method Modifications from Reference
N/A

3. Reporting Limits

The reporting limit for PFAS’s are listed in Table 8.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/2 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.1. Subtracting blank values from sample results is not permitted.

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization
source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as “likely to be carcinogenic to humans.” Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 500-mL or 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap. All sample containers must have linerless HDPE or polypropylene caps.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Maintain all aqueous samples protected from light at 0 - 6 ºC from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 ºC during transport and be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt.
Once received by the laboratory, the samples must be stored at ≤-20 °C until sample preparation.

6.2 Sample Collection for Solid and Oil samples.

6.2.1 Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided. Samples should fill no more than ¾ full.

6.2.2 Maintain solid samples protected from light (in HDPE containers) at 0 - 6 ºC from the time of collection until receipt at the laboratory. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤-20 ºC until sample preparation.

6.3 Sample Collection for fish and other tissue samples

6.3.1 If the time of collection to the time of receipt at the laboratory is expected to exceed 24 hours, the tissue samples must be frozen upon collection and shipped to the laboratory on dry ice.

6.3.2 Once received by the laboratory, the samples must be maintained protected from light at ≤-20 ºC until prepared. Store unused samples in HDPE containers or wrapped in aluminum foil at ≤-20 ºC.

6.3.3 The nature of the tissues of interest may vary by project. Field sampling plans and protocols should explicitly state the samples to be collected and if any processing will be conducted in the field (e.g., filleting of whole fish or removal of organs). All field procedures must involve materials and equipment that have been shown to be free of PFAS.

6.4 Sample Preservation

Not applicable.

6.5 Sample Shipping

Samples must be chilled during shipment and must not exceed 0 – 6 ºC during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 0 – 6 ºC when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 ºC until extraction but should not be frozen.

NOTE: Samples that are significantly above 0 – 6 ºC, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.6 Sample Handling

6.6.1 Aqueous samples (including leachates) should be analyzed as soon as possible; however, samples may be held in the laboratory for up to 90 days from collection, when stored at ≤-20 ºC and protected from the light. When stored at 0 - 6 ºC and protected from the light, aqueous samples may be held for up to 28 days, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after 7 days. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.
6.6.2 Solid samples (soils and sediments), Oil and tissue samples may be held for up to 90 days, if stored by the laboratory in the dark at either 0 - 6 ºC or ≤ -20 ºC, with the caveat that samples may need to be extracted as soon as possible if NFDHA is an important analyte.

6.6.3 Biosolids samples may be held for up to 90 days, if stored by the laboratory in the dark at 0 - 6 ºC or at -20 ºC. Because microbiological activity in biosolids samples at 0 - 6 ºC may lead to production of gases which may cause the sample to be expelled from the container when it is opened, as well as producing noxious odors, EPA recommends that samples be frozen if they need to be stored for more than a few days before extraction. Store sample extracts in the dark at less than 0 - 4 ºC until analyzed. If stored in the dark at less than 0 - 4 ºC, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 500-mL or 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 SAMPLE JARS – 8-ounce wide mouth high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.3 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.4 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.5 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.5.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.6 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.7 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-μls.

7.8 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.9 Silanized glass wool (Sigma-Aldrich, Cat # 20411 or equivalent) – store in a clean glass jar and rinsed with methanol (2 times) prior to use.

7.10 Disposable syringe filter, 25-mm, 0.2-µm Nylon membrane, PALL/Acrodisc or equivalent

7.11 Variable volume pipettes with disposable HDPE or polypropylene tips (10 μL to 5 mL) used for preparation of calibration standards and spiked samples.

7.12 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.
7.13 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.1 g.

7.14 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.14.1 SPE CARTRIDGES – (Phenomenex WAX 150 or 250mg or equivalent). The SPE sorbent must have a pKa above 8 so that it remains positively charged during the extraction.

7.14.1.1 Note: SPE cartridges with different bed volume (e.g., 500 mg) may be used; however, the laboratory must demonstrate that the bed volume does not negatively affect analyte absorption and elution, by performing the initial demonstration of capability analyses described in Section 13.

7.14.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met.Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB.

7.14.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB and LCS QC requirements.

7.15 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 55 °C.

7.16 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.17 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.17.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-μL aliquots and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

7.17.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.
7.17.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.17.4 INSTRUMENT COLUMNS

7.17.4.1 ANALYTICAL: C18 column, 1.7 µm, 50 x 2.1 mm (Waters Acquity UPLC® BEH or equivalent)

7.17.4.2 OPTIONAL GUARD COLUMN: (Phenomenex Kinetex® Evo C18 or equivalent)

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals must be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/2 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system’s tubing.

8.1.2 METHANOL (CH₃OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE (NH₄C₂H₃O₂, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences. Store at 2-8°C and replace 2 years after opening date.

8.1.4 ACETIC ACID (H₃CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences and stored at room temperature.

8.1.4.1 Acetic Acid (0.1%) – Dissolve acetic acid (1 mL) in reagent water (1 L), store at room temperature, replace after 3 months.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into 1 L of REAGENT WATER.

8.1.7 ACETONITRILE – UPLC grade or equivalent, store at room temperature

8.1.8 TOLUENE – HPLC grade or equivalent.

8.1.9 ACETONE – pesticide grade or equivalent

8.1.10 AMMONIUM HYDROXIDE (NH₃, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences, and stored at room temperature.
8.1.11 AQUEOUS AMMONIUM HYDROXIDE (3%) – Add ammonium hydroxide (10 mL, 30%) to reagent water (90 mL), store at room temperature, replace after 3 months.

8.1.12 METHANOLIC AMMONIUM HYDROXIDE (0.3%) - add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month

8.1.13 METHANOLIC AMMONIUM HYDROXIDE (1%) - add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month

8.1.14 METHANOLIC AMMONIUM HYDROXIDE (2%) - add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month

8.1.15 METHANOLIC POTASSIUM HYDROXIDE (0.05 M) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months

8.1.16 METHANOL WITH 4% WATER, 1% AMMONIUM HYDROXIDE AND 0.625% ACETIC ACID - add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and calibration standards (Section 8.3.2).

8.1.17 FORMIC ACID – (greater than 96% purity or equivalent). Store at room temperature and replace after 2 years.

8.1.18 FORMIC ACID (aqueous, 0.1 M) - dissolve formic acid (4.6 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.19 FORMIC ACID (aqueous, 0.3 M) - dissolve formic acid (13.8 g) in reagent water (1 L), store at room temperature, replace after 2 years.

8.1.20 FORMIC ACID (aqueous, 5% v/v) - mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years.

8.1.21 FORMIC ACID (methanolic 1:1, 0.1 M formic acid/methanol) - mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years.

8.1.22 FORMIC ACID (aqueous, 50% v/v) - mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years.

8.1.23 POTASSIUM HYDROXIDE – certified ACS or equivalent, store at room temperature, replace after 2 years.

8.1.24 CARBON - -- EnviCarb® 1-M-USP or equivalent, verified by lot number before use, stored at room temperature. Loose carbon allows for better adsorption of interferent organics. Note: The single-laboratory validation laboratory achieved better performance with loose carbon than carbon cartridges. Loose carbon will be used for the multi-laboratory validation to set statistically based method criteria.
8.1.25 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer’s specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.26 ARGON – Used as collision gas in some MS/MS instruments. Argon should meet or exceed instrument manufacturer’s specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 REFERENCE MATRICES - Matrices in which PFAS and interfering compounds are not detected by this method. These matrices are to be used to prepare the batch QC samples, LOQ/MDL, and IDOC samples.

8.2.1 Reagent water - purified water, Type I

8.2.2 Solid reference matrix Ottawa Sand or equivalent

8.2.3 Tissue Reference matrix – Cod loin or other animal tissue demonstrated to be PFAS free.

8.3 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers and are stored at ≤4 °C. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

8.3.1 Stock standards and diluted stock standards are stored at ≤4 °C. Prepare a spiking solution, containing the method analytes listed in Table 1, in methanol from prime stocks. The solution is used to prepare the calibration standards and to spike the known reference QC samples that are analyzed with every batch. Quantitative standards containing a mixture of branched and linear isomers must be used for method analytes if they are commercially available. Currently, these include PFOS, PFHxS, NEtFOSAA, and NMeFOSAA.

8.3.2 Calibration standard solutions – A series of calibration solutions containing the target analytes and the Labeled extracted internal standards (EIS) and non-extracted internal standards (NIS) is used to establish the initial calibration of the analytical instrument. Table 4 represents the concentrations of the native, EIS and NIS analytes of the calibration curve. Calibration standard solutions are made using the solution described in section 8.1.16.

8.3.3 ISOTOPE DILUTION EXTRACTED INTERNAL STANDARD (EIS) – Isotopically labelled analogs of the target analytes to be used for the quantification of target analytes. EIS stock standard solutions are purchased in glass ampoules and are stored in accordance with the manufacturer’s recommendations. The EIS stock solution to be used for the fortification of samples and QC in accordance with the isotope dilution procedure. Table 2 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.
8.3.4 ISOTOPE DILUTION NON-EXTRACTED INTERNAL STANDARDS (NIS) – Isotopically labelled analogs to be added post extraction for the measurement of EIS extraction efficiency and is added to the final volume of all extractions. Table 3 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

9. Quality Control

9.1 Method Blank

9.1.1 A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and standards. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination, and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.2 Laboratory Control Sample (LCS)

9.2.1 Low Level LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LLCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at 2X the LOQ. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%R) for each analyte using the equation:

\[ \%R = \frac{A}{B} \times 100 \]

Where:
- \( A \) = measured concentration in the fortified sample
- \( B \) = fortification concentration.

9.2.2 An LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at the midpoint of the calibration curve. Default limits of 70-130% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%R) for each analyte using the equation:

\[ \%R = \frac{A \times 100}{B} \]

Where:
- \( A \) = measured concentration in the fortified sample
- \( B \) = fortification concentration.

9.1.1 Where applicable, in the absence of additional sample volume required to perform matrix specific QC, LCSD’s are to be extracted and analyzed. The concentration and analyte
recovery criteria for the LCSD must be the same as the batch LCS. The RSD’s must fall within ≤30% of the true value for medium and high-level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

\[
RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100
\]

9.1.2 If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.3 Non-extracted Internal Standard Area (NIS)

Each time an initial calibration is performed, use the data from all the initial calibration standards used to meet the linearity test in Section 10.3.3.3 to calculate the mean area response for each of the NIS compounds, using the equation below.

\[
\text{Mean Area}_{\text{NIS}} = \frac{\sum \text{Area}_{\text{NISi}}}{n}
\]

where:

\( \text{Area}_{\text{NISi}} \) = Area counts for the ith NIS, where i ranges from 1 to 7, for the seven NIS compounds listed in Table 1

n = The number of ICAL standards (the default value is n = 6). If a different number of standards is used for the ICAL, for example, to increase the calibration range or by dropping a point at either end of the range to meet the linearity criterion, change 6 to match the actual number of standards used.

Record the mean areas for each NIS for use in evaluating results for sample analyses. There is no acceptance criterion associated with the mean NIS area data.

9.4 Extracted Internal Standards (EIS)

9.4.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation:

\[
\%R = \left( \frac{A}{B} \right) \times 100
\]

Where:

\( A \) = calculated EIS concentration for the QC or Field Sample

\( B \) = fortified concentration of the EIS.

9.4.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4)
instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria, the data must be reanalyzed.

9.5 Matrix Spike (MS/MSD)

9.5.1 Analysis of an MS is prepared one per preparation batch (if required).

9.5.2 Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch. Aliquots of field samples

9.5.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6 Laboratory Duplicate

9.6.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.6.2 Calculate the relative percent difference (RPD) for duplicate measurements (FD1 and FD2) using the equation:

\[ RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100 \]

9.6.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.6.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation:

\[ RPD = \frac{|MS - MSD|}{(MS + MSD) / 2} \times 100 \]
9.6.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Bile Salt Interference Check

9.7.1 The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

9.8 Initial Calibration Verification (ICV)

9.8.1 After each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ± 30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

9.9 Instrument Sensitivity Check (ISC)

9.9.1 At the start of each 12-hour shift, analyze a standard at the LOQ. The signal-to-noise ratio of the ISC standard must be greater than or equal to 3:1. If the requirements cannot be met, the problem must be corrected before analyses can proceed.

9.10 Continuing Calibration Verification (CCV)

9.10.1 CCV Standards must be analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch.

9.10.2 The recovery of native and isotopically labeled compounds for the CVs must be within 70 - 130%

9.11 Method-specific Quality Control Samples

9.11.1 Instrument Blank – During the analysis of a batch of samples, a solvent blank is analyzed after samples containing high level of target compounds (e.g., calibration, CV) to monitor carryover from the previous injection. The injection blank consists of the solution in Section 8.1.16 fortified with the EIS and NIS for quantitation purposes.

9.12 Example Method Sequence
10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements.

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected.

10.1.3 The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.1.4 All SPE apparatus, including manifolds, tubing and sample ports must be thoroughly rinsed following each use with 1% methanolic ammonium hydroxide, followed by Methanol and then DI water. Additionally, sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or...
discoloration. When such observations are made, the associated components should be replaced.

10.1.5 Prior to the start of any extraction, sample site information must be evaluated for any potentially high level PFAS concentrations or sample matrix irregularities that may impact the extraction process. If such samples are identified, aqueous samples may be pre-screened via direct aqueous injection prior to analysis to estimate the potential PFAS concentrations present.

10.1.6 To perform a direct aqueous injection (DAI) screen, the sample should be inverted several times to try and evenly disperse any organic matter present. A 1 ml aliquot (or less depending on the matrix) is to be taken from the parent sample, volume adjusted to 1 ml with reagent water if less than 1ml, fortified with EIS and NIS spiking solutions to match the concentrations of an extracted sample (typically 5 µl per 1 ml DAI), and then analyzed under the same analytical conditions as field samples.

10.2 Sample Preparation of Aqueous Samples

10.2.1 Samples are preserved, collected, and stored as presented in Section 6.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS’s adsorb to surfaces, thus the sample volume may not be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring reagent water with a polypropylene graduated cylinder or filling an HDPE sample bottle near the top.

10.2.4 Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide and 3% aqueous ammonium hydroxide. The extract is now ready for solid-phase extraction (SPE) and cleanup.

10.2.5 Add 20 µL of the EIS to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3 Sample Prep and Extraction Protocol for Solids.

10.3.1 Homogenize and weigh 5 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 5 grams of clean sand is used.

10.3.1.1 For Biosolids and other complex matrices, a small aliquot may be required due to co-extracted matrix interferences.

10.3.1.2 For batch QC samples using 5 g of reference solid, add 2.5 g of reagent water. The addition of reagent water to the sand provides a matrix closer in composition to real-world samples.

10.3.2 Add 20 µL of the EIS to each sample and QC.

10.3.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.
10.3.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.3.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.3.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.3.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.3.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.3.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.3.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.3.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.3.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.3.13 Dilute to approximately 35 mL with reagent water. Samples containing more than 50% water may yield extracts that are greater than 35 mL in volume; therefore, do not add water to these. Determine the water content in the sample as follows (percent moisture is determined from the % solids):

\[ \text{Water Content in Sample} = \frac{(\text{Sample Weight} \times \text{Percent moisture})}{100} \]

10.3.14 Concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume that is based on the water content of the sample (see table below). Allow extracts to concentrate for 10 minutes, then mix (by vortex if the volume is < 20). Continue concentrating and mixing every 5 minutes until the extract has been reduced to the required volume as specified in the table below. If the extract volume appears to stop dropping, the concentration must be stopped and the volume at which it was stopped recorded.

<table>
<thead>
<tr>
<th>Water Content in Sample</th>
<th>Concentrated Final Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 grams</td>
<td>15 ml</td>
</tr>
<tr>
<td>5-8 grams</td>
<td>15-20 ml</td>
</tr>
<tr>
<td>8-9 grams</td>
<td>20-22.5 ml</td>
</tr>
<tr>
<td>9-10 grams</td>
<td>22.5-25 ml</td>
</tr>
</tbody>
</table>

10.3.15 Add 40 - 50 mL of reagent water to the extract and vortex. Check that the pH is 6.5 ±0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide, or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.4 Sample Prep and Extraction Protocol for Oils.
10.4.1 Weigh 1-2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 1 grams of mineral oil is used.

10.4.1.1 For batch QC samples use 1 g of reference oil.

10.4.2 Add 20 µL of the EIS to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.4.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.4.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.4.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.4.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.4.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.4.9 Repeat steps 10.4.4 to 10.4.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.4.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.4.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.4.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.5 Sample Prep and Extraction Protocol for Tissues.

10.5.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean tissue is used.

10.5.2 Add 20 µL of the EIS PDS to each sample and QC.

10.5.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.5.4 Add 10 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a mixing table to extract for at 16 hours. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant in a 50-mL polypropylene centrifuge tube.

10.5.5 Add 10 mL of acetonitrile to remaining tissue in the 50-mL centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the initial extract.

10.5.6 Add 5 mL of 0.05M KOH in methanol to the remaining sample in each centrifuge tube. Vortex to disperse the tissue and hand mix briefly. Centrifuge at 2800 rpm
for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the first two extracts.

**10.5.7** Add 10 mg of carbon to the combined extract, mix by occasional hand shaking over a period of no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50-mL centrifuge tube.

**10.5.8** Add 1 mL of reagent water to each tube and concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume of 2.5 ml.

**10.5.9** Add reagent water to each evaporation/concentrator tube to dilute the extracts to 50 mL. Check that the pH = 6.5 ± 0.5 and adjust as needed with 50% formic acid, or ammonium hydroxide or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

**10.6 SPE Extract: All matrices**

**10.6.1** Pack clean silanized glass wool to half the height of the WAX SPE cartridge barrel.

**10.6.2** Pre-condition the cartridges by washing them with 3 X 5 mL of 1% methanolic ammonium hydroxide, discarding the wash volumes.

**10.6.3** Rinse the cartridge with 5 mL of 0.3M formic acid, allowing the cartridge to drain using gravity only, discarding the rinse volume. Do not allow the cartridge to go dry.

**10.6.4** Adjust the vacuum so that the approximate flow rate is ~5 mL/min and load the sample across the cartridge. Do not allow the cartridge to go dry before all the sample has passed through.

**10.6.5** Once all the sample has passed across the cartridge, rinse the walls of the reservoir with 2 X 5 mL reagent water, loading the rinse across the cartridge.

**10.6.6** Rinse the walls of the reservoir with 5 mL of 1:1 0.1M formic acid/methanol and pass the rinse through the cartridge using vacuum. Dry the cartridge by pulling air through for 15 seconds.

**10.6.7** Rinse the inside of the sample bottle with 5 mL of 1% methanolic ammonium hydroxide. Use vacuum to pull the elution solvent through the cartridge and into the collection tubes. When the cartridge bed and glass wool are submerged, stop the cartridge flow by closing the valve, keeping the sorbent bed and wool submerged.

**10.6.8** Let the wetted sorbent bed and wool soak for 1 minute.

**10.6.9** Open the cartridge valve and collect the eluate into a 15 ml polypropylene collection tube.

**10.6.10** Add 25 µL of concentrated acetic acid to each sample eluted in the collection tubes and vortex to mix.

**10.6.11** Add 10 mg of carbon to each sample and batch QC extract, using a 10-mg scoop. Handshake occasionally for no more than 5 minutes. It is important to minimize the time the sample extract is in contact with the carbon. Immediately vortex (30 seconds) and centrifuge at 2800 rpm for 10 minutes.

**10.6.12** Add NIS solution to a clean collection tube. Place a syringe filter (25-mm filter, 0.2-µm nylon membrane) on a 5-mL polypropylene syringe. Take the plunger out and carefully decant the sample supernatant into the syringe barrel. Replace the
plunger and filter the entire extract into the new collection tube containing the NIS.

10.6.13 Vortex to mix and transfer a portion of the extract into a .7-mL polypropylene LC vial for LC-MS/MS analysis. Cap the collection tube containing the remaining extract and store at 4 °C.

10.7 Sample Volume Determination

10.7.1 If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight. Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration.

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- or [M-CO₂]- for each method analyte by infusing approximately 0.5-1.0 μg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

The Mass spec conditions found in Table 7 show the Sciex Triple Quad 5500+ operation conditions used in this method.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 μg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions, and the sulfonic acids have similar MS/MS conditions.

The conditions found on table 5 are representative of expected tune optimizations for each analyte. If conditions other the ones close to the values provided in table 5 are achieved, the process should be re-performed and/or instrument maintenance performed to resolve the problem.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.
Table 6 represents the operation conditions of a Sciex Exion LC system when running this method.

10.8.3 Inject 2µl of a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as outlined in table 5. The lowest concentration CAL standard must be at or below the LOQ.

10.8.6 The LC/MS/MS system is calibrated using the isotope dilution technique. Target analytes are quantitated against their isotopically labeled analog (Extracted Internal Standard) where commercially available. If a labeled analog is not commercially available, the extracted internal standard with the closest retention time and /or closest chemical similarity is to be used. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve must always be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 6 calibration points are required for a linear or quadratic calibration model.

10.8.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the calculated RSD or RSE for each target analyte is ≤20%. If linear or Quadratic regressions are used, coefficient of determination ($r^2$) values must be greater than 0.99. When quantitated using the initial calibration curve, each calibration point at or above the LOQ for each analyte must calculate to be within 70-130% of its true value. The calculate value of each EIS analyte must be within 50-150% of its true value. If these criteria cannot be met, corrective action is taken to reanalyze the CAL standards, restrict the range of calibration.

10.8.8 Bile salts interference check - The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

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Document Type: SOP-Technical

Pre-Qualtrax Document ID: NA
retention window for PFOS by at least one minute), and the initial calibration repeated.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a “sample” is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each native and EIS analyte for medium level CCVs must be within ± 30% of the true. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed with the following exception. If the CCV fails because the calculated concentration is greater than 130% for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration and verification of sensitivity by analyzing a CCV at or below the LOQ.

10.10 EXTRACT ANALYSIS

10.10.1 The same operating conditions used for the initial calibration and summarized in Tables 6 and 7 are to be used.

10.10.2 Prior to analysis of sample extracts, the Instrument mass calibration verification must be performed using standards whose mass range brackets the masses of interest and performed in the negative ion mode. The mass calibration is verified if the calculated mass is within ± .2 daltons of the specified mass.

10.10.3 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.
10.10.4 Calibrate the system by either the analysis of a calibration curve or by confirming the initial calibration is still valid by analyzing a CCV.

10.10.5 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.6 For concentrations at or above the method LOQ, the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response ratio must fall within ± 50% of the ratio observed in the midpoint initial calibration standard.

10.10.7 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.7.1 Method analyte, EIS analyte, and NIS analyte RTs must fall within 0.4 minutes of the predicted retention times from the midpoint standard of the ICAL or initial daily CV, whichever was used to establish the RT window position for the analytical batch. All branched isomer peaks identified in either the calibration standard or the qualitative (technical grade) standard must fall within in the retention time window for that analyte.

10.10.7.2 For all method analytes with exact corresponding isotopically labeled analogs, method analytes must elute within 0.1 minutes of the associated EIS.

10.10.8 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to ensure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

10.10.9 In instances where re-extraction is not an option, dilute a subsample of the sample extract with 0.1% acetic acid by a factor no greater than 10x adjust the amount of the NIS in the diluted extract, and analyze the diluted extract. If the responses for each EIS in the diluted extract meet the S/N and retention time, and the EIS recoveries from the analysis of the diluted extract are greater than 5%, then the compounds associated with those EISs may be quantified using isotope dilution. Use the EIS recoveries from the original analysis to select the dilution factor, with the objective of keeping the EIS recoveries in the dilution above that 5% lower limit. If the adjusted EIS recoveries are below 5%, the dilution is assumed invalid. If the adjusted EIS recoveries are greater than 5%, adjust the compound concentrations, detection limits, and minimum levels to account for the dilution.

11. Data Evaluation, Calculations and Reporting
11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 9.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.9. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.8.

\[ C_{ex} = \frac{\text{Area of target analyte} \times \text{Concentration of Labeled analog}}{\text{Area of labeled analog} \times \text{CF}} \]

\[ C_s = \frac{C_{ex}}{\text{sample volume in ml}} \times 1000 \]

\[ C_{ex} = \text{The concentration of the analyte in the extract} \]

\[ \text{CF} = \text{calibration factor from calibration.} \]

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 due to the linear and branch isomers of these compounds (Sect. 10.10.4.). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)
13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

13.2.1 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.2 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha’s Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124
SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP
SOP ID 1739 Demonstration of Capability (DOC) Generation SOP
SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments
### Table 1: Names, Abbreviations, and CAS Registry Numbers for Target PFAS, Extracted Internal Standards and Non-extracted Internal Standards

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Acronym</th>
<th>CAS</th>
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<tr>
<td>PER- and POLYFLUOROALKYLETHER CARBOXYLIC ACIDS (PFECAs)</td>
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<tr>
<td>Tetrafluoro-2-(heptafluoropropoxy)propanoic acid</td>
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<td>4,8-dioxa-3H-perfluorononanoic acid</td>
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<td>Perfluoro-4-methoxybutanoic acid</td>
<td>PFMBA</td>
<td>863090-89-5</td>
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<tr>
<td>Nonafluoro-3,6-dioxaheptanoic acid</td>
<td>NFDHA</td>
<td>151772-58-6</td>
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<td>PERFLUOROALKYL CARBOXILIC ACIDS (PFCAs)</td>
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<tr>
<td>Perfluorobutanoic acid</td>
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**PERFLUOROALKYL SULFONIC ACIDS (PFASs)**

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<th>Chemical Name</th>
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<tr>
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**CHLORO-PERFLUOROALKYL SULFONATE**

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<tr>
<td>Perfluoro(2-ethoxyethane)sulfonic acid</td>
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<td>9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid</td>
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**FLUOROTELOMER CARBOXYLIC ACIDS**

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<td>Perfluoroheptyl propanoic acid</td>
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**PERFLUOROOCTANESULFONAMIDES**

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<td>N-methylperfluoro-1-octanesulfonamide</td>
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<td>N-ethylperfluoro-1-octanesulfonamide</td>
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**PERFLUOROOCTANE SULFONAMIDE ETHANOLS**

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**TELOMER SULFONIC ACIDS**

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**PERFLUOROOCTANESULFONAMIDOACETIC ACIDS**

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N-methyl perfluorooctanesulfonamidooic acid | NMeFOSAA | 2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid | NEtFOSAA | 2991-50-6

**PERFLUOROETHER AND POLYETHER CARBOXYLUIC ACIDS**

| Perfluoro-3-methoxypropanoic acid | PFMPA | 377-73-1 |
| Perfluoro-4-methoxybutanoic acid | PFMB | 863090-89-5 |
| Perfluoro(2-ethoxyethane)sulfonic acid | PFEESA | 113507-82-7 |
| Nonafluoro-3,6-dioxaheptanoic acid | NFDHA | 151772-58-6 |

**Table 2: Stock and Nominal Extracted Internal Standard Concentrations**

<table>
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<tr>
<th>Isotope Labeled Standard</th>
<th>Conc. of EIS Stock (ng/mL)</th>
<th>Nominal amount of EIS added to extracts (ng)</th>
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<td>M4PFBA</td>
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<td>M5PFPeA</td>
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<td>M5PFHxA</td>
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<td>10</td>
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<td>10</td>
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Document Type: SOP-Technical

Pre-Qualtrax Document ID: NA
Table 6: LC Method Conditions

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>2 mM Ammonium Acetate (5:95 CH/H₂O)</th>
<th>100% Acetonitrile</th>
<th>Gradient Curve</th>
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<tr>
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<td>11.8</td>
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<td>1</td>
</tr>
</tbody>
</table>

Waters Aquity UPLC ® BEHC\textsubscript{18} 2.1 x 50 mm packed with 1.7 µm BEH C\textsubscript{18} stationary phase
Flow rate of 0.4 mL/min
2 µL injection

Table 7: ESI-MS Method Conditions

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<th>ESI Conditions</th>
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<tr>
<td>Polarity</td>
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<td>Curtain Gas</td>
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<td>Collision gas</td>
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<tr>
<td>Ion Spray Voltage</td>
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<tr>
<td>Desolvation gas temp.</td>
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<td>Ion Source Gas 2</td>
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<td>Entrance Potential</td>
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<tr>
<td>Exic Cell Potential</td>
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## Table 8. Reporting limits by Matrix

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<tr>
<th>Compound</th>
<th>Aqueous (ng/L)</th>
<th>Solid (ng/g)</th>
<th>Tissue (ng/g)</th>
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<td>0.5</td>
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<td>0.5</td>
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<tr>
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<td>0.2</td>
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<td>8:2FTS</td>
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<td>NEtFOSAA</td>
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</table>
APPENDIX E

COMMUNITY AIR MONITORING PLAN
New York State Department of Health Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area and when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH. Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during building slab demolition. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind and upwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of
calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

**Particulate Monitoring, Response Levels, and Actions**

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.
Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m³, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m³ or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work with Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.