Material Safety Data Sheet

Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

Section 1. Chemical product and company identification

| Product name | Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen |
| Supplier     | AIRGAS INC., on behalf of its subsidiaries                                           |
|              | 259 North Radnor-Chester Road                                                        |
|              | Suite 100                                                                             |
|              | Radnor, PA 19087-5283                                                                 |
|              | 1-610-687-5253                                                                       |
| Product use  | Synthetic/Analytical chemistry.                                                       |
| MSDS #       | 002253                                                                               |
| Date of Preparation/Revision | 4/19/2013.                     |
| In case of emergency | 1-866-734-3438.                   |

Section 2. Hazards identification

| Physical state | Gas.                                                                                  |
|               | DANGER!                                                                               |
|               | MAY BE FATAL IF INHALED.                                                               |
|               | MAY CAUSE EYE AND SKIN IRRITATION.                                                    |
|               | CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.           |
|               | CONTENTS UNDER PRESSURE.                                                              |
|               | Do not puncture or incinerate container. Do not breathe gas. Avoid contact with eyes, skin and clothing. Contains material that may cause target organ damage, based on animal data. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed. Contact with rapidly expanding gases can cause frostbite. |
| Target organs | Contains material which may cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, upper respiratory tract, eyes, central nervous system (CNS). |
| Routes of entry | Inhalation Dermal Eyes |
| Potential acute health effects | Eyes : Moderately irritating to eyes. Contact with rapidly expanding gas may cause burns or frostbite. |
|                                             | Skin : Moderately irritating to the skin. Contact with rapidly expanding gas may cause burns or frostbite. |
|                                             | Inhalation : Very toxic by inhalation. |
|                                             | Ingestion : Ingestion is not a normal route of exposure for gases |
| Potential chronic health effects |
| Chronic effects | Contains material that may cause target organ damage, based on animal data. |
| Target organs | Contains material which may cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, upper respiratory tract, eyes, central nervous system (CNS). |
| Medical conditions aggravated by over-exposure | Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product. |

See toxicological information (Section 11)
Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

Section 3. Composition, Information on Ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS number</th>
<th>% Volume</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>72 - 99</td>
<td>Oxygen Depletion [Asphyxiant]</td>
</tr>
<tr>
<td>Oxygen</td>
<td>7782-44-7</td>
<td>1 - 19.5</td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>630-08-0</td>
<td>0.0025 - 5</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>74-82-8</td>
<td>0.1 - 3</td>
<td>ACGIH TLV (United States, 2/2010). TWA: 29 mg/m³ 8 hour(s).</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>7783-06-4</td>
<td>0.001 - 1</td>
<td>ACGIH TLV (United States, 2/2010). STEL: 5 ppm 15 minute(s).</td>
</tr>
</tbody>
</table>

Section 4. First aid measures

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.

**Eye contact**: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. 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. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

**Frostbite**: Try to warm up the frozen tissues and seek medical attention.

**Inhalation**: Call medical doctor or poison control center immediately. Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Ingestion**: As this product is a gas, refer to the inhalation section.
Section 5. Fire-fighting measures

Flammability of the product : Non-flammable.
Flash point : Lowest known value: Closed cup: -188.15°C (-306.7°F). (methane)
Flammable limits : Greatest known range: Lower: 12.5% Upper: 74.2% (carbon monoxide)
Products of combustion : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides
sulfur oxides
Fire-fighting media and instructions : Use an extinguishing agent suitable for the surrounding fire.
Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.
Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
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 : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Methods for cleaning up : 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

Handling : Use only with adequate ventilation. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Avoid contact with skin and clothing. Avoid contact with eyes. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Storage : 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

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.
Personal protection
   Eyes : 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 or dusts.
   Skin : 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.
   Respiratory : 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.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
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Hands
- 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.

Personal protection in case of a large spill
- Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name
- Oxygen Depletion [Asphyxiant]
- Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Melting/freezing point:
- -85.49°C (-121.9°F) This is based on data for the following ingredient: hydrogen sulphide. Weighted average: -209.48°C (-345.1°F)

Critical temperature:
- Lowest known value: -146.9°C (-232.4°F) (nitrogen).

Vapor density:
- Highest known value: 1.19 (Air = 1) (hydrogen sulphide). Weighted average: 0.98 (Air = 1)

Gas Density (lb/ft³):
- Weighted average: 0.07

Section 10. Stability and reactivity

Stability and reactivity:
- The product is stable.

Incompatibility with various substances:
- Extremely reactive or incompatible with the following materials: reducing materials and combustible materials.

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

**Toxic data**

<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>carbon monoxide</td>
<td>TDLo Intraperitoneal</td>
<td>Rat</td>
<td>35 mL/kg</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>LC50 Inhalation</td>
<td>Rat</td>
<td>13500 mg/m3</td>
<td>15 minutes</td>
</tr>
<tr>
<td></td>
<td>Vapor</td>
<td>Rat</td>
<td>1900 mg/m3</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>LC50 Inhalation</td>
<td>Rat</td>
<td>6600 ppm</td>
<td>30 minutes</td>
</tr>
<tr>
<td></td>
<td>Vapor</td>
<td>Gas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LC50 Inhalation</td>
<td>Rat</td>
<td>3760 ppm</td>
<td>1 hours</td>
</tr>
<tr>
<td></td>
<td>Gas.</td>
<td>Mouse</td>
<td>2444 ppm</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rat</td>
<td>1807 ppm</td>
<td>4 hours</td>
</tr>
<tr>
<td>hydrogen sulphide</td>
<td>LC50 Inhalation</td>
<td>Rat</td>
<td>820 mg/m3</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Vapor</td>
<td>Rat</td>
<td>700 mg/m3</td>
<td>4 hours</td>
</tr>
<tr>
<td></td>
<td>LC50 Inhalation</td>
<td>Rat</td>
<td>470 mg/m3</td>
<td>6 hours</td>
</tr>
<tr>
<td></td>
<td>Vapor</td>
<td>Rat</td>
<td>712 ppm</td>
<td>1 hours</td>
</tr>
<tr>
<td></td>
<td>LC50 Inhalation</td>
<td>Mouse</td>
<td>634 ppm</td>
<td>1 hours</td>
</tr>
<tr>
<td></td>
<td>Gas.</td>
<td>Rat</td>
<td>444 ppm</td>
<td>4 hours</td>
</tr>
</tbody>
</table>

**Chronic effects on humans**: Contains material which may cause damage to the following organs: blood, lungs, the nervous system, heart, cardiovascular system, upper respiratory tract, eyes, central nervous system (CNS).

**Other toxic effects on humans**: No specific information is available in our database regarding the other toxic effects of this material to humans.

**Specific effects**

- **Carcinogenic effects**: No known significant effects or critical hazards.
- **Mutagenic effects**: No known significant effects or critical hazards.
- **Reproduction toxicity**: No known significant effects or critical hazards.

Section 12. Ecological information

**Aquatic ecotoxicity**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Test</th>
<th>Result</th>
<th>Species</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrogen sulphide</td>
<td>-</td>
<td>Acute EC50 770 ug/L Fresh water</td>
<td>Crustaceans - Amphipod - Crangonyx richmondensis ssp. lauren - 10 mm</td>
<td>48 hours</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Acute EC50 540 ug/L Fresh water</td>
<td>Crustaceans - Amphipod - Crangonyx richmondensis ssp. lauren - 10 mm</td>
<td>48 hours</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Acute EC50 95 ug/L Fresh water</td>
<td>Crustaceans - Scud - Gammarus pseudolimnaeus - 11 mm</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Acute EC50 71 ug/L Fresh water</td>
<td>Crustaceans -</td>
<td>2 days</td>
</tr>
</tbody>
</table>
Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

Environmental fate: Not available.
Environmental hazards: No known significant effects or critical hazards.
Toxicity to the environment: Not available.

Fresh water
- Acute EC50 62 ug/L
  Fresh water
  Scud - Gammarus pseudolimnaeus - 11 mm
  Crustaceans - Scud - Gammarus pseudolimnaeus - 11 mm
  2 days

Fresh water
- Acute LC50 7 ug/L
  Fresh water
  Fish - Fathead minnow - Pimephales promelas - Fry
  96 hours

Fresh water
- Acute LC50 4 ug/L
  Fresh water
  Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry
  96 hours

Fresh water
- Acute LC50 3.2 ug/L
  Fresh water
  Fish - Asian redtail catfish - Hemibagrus nemurus
  96 hours

Fresh water
- Acute LC50 3 ug/L
  Fresh water
  Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry
  96 hours

Fresh water
- Acute LC50 2 ug/L
  Fresh water
  Fish - Lake whitefish - Coregonus clupeaformis - Yolk-sac fry
  96 hours

Fresh water
- Acute LC50 <2 ug/L
  Fresh water
  Fish - Yellow perch - Perca flavescens - Yolk-sac fry
  96 hours

Products of degradation: carbon oxides (CO, CO$_2$) and water, nitrogen oxides (NO, NO$_2$ etc.), sulfur oxides (SO$_2$, SO$_3$ etc.).

Section 13. Disposal considerations
Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

<table>
<thead>
<tr>
<th>Regulatory information</th>
<th>UN number</th>
<th>Proper shipping name</th>
<th>Class</th>
<th>Packing group</th>
<th>Label</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT Classification</td>
<td>UN1956</td>
<td>COMPRESSED GAS, N.O.S.</td>
<td>2.2</td>
<td>Not applicable (gas).</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

**TDG Classification**

| UN1956 | COMPRESSED GAS, N.O.S. | 2.2 | Not applicable (gas). |

**Mexico Classification**

| UN1956 | COMPRESSED GAS, N.O.S. | 2.2 | Not applicable (gas). |

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

**Section 15. Regulatory information**

**United States**

**U.S. Federal regulations**

- TSCA 8(a) IUR: Not determined
- United States inventory (TSCA 8b): All components are listed or exempted.

**SARA 302/304/311/312 extremely hazardous substances**: hydrogen sulphide
**SARA 302/304 emergency planning and notification**: hydrogen sulphide
**SARA 302/304/311/312 hazardous chemicals**: nitrogen; oxygen; methane; carbon monoxide; hydrogen sulphide

**SARA 311/312 MSDS distribution - chemical inventory - hazard identification**: nitrogen: Sudden release of pressure; oxygen: Fire hazard, Sudden release of pressure, Delayed (chronic) health hazard; methane: Fire hazard, Sudden release of pressure; carbon monoxide: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard; hydrogen sulphide: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

**Clean Air Act (CAA) 112 accidental release prevention - Flammable Substances**: Methane

**Clean Air Act (CAA) 112 accidental release prevention - Toxic Substances**: Hydrogen Sulfide

**Clean Air Act (CAA) 112 regulated flammable substances**: methane

**Clean Air Act (CAA) 112 regulated toxic substances**: hydrogen sulphide

**SARA 313**

**Form R - Reporting requirements**

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>7783-06-4</td>
<td>0.001 - 1</td>
</tr>
</tbody>
</table>

**Supplier notification**

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>7783-06-4</td>
<td>0.001 - 1</td>
</tr>
</tbody>
</table>

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

**State regulations**

- **Connecticut Carcinogen Reporting**: None of the components are listed.
- **Connecticut Hazardous Material Survey**: None of the components are listed.
- **Florida substances**: None of the components are listed.
- **Illinois Chemical Safety Act**: None of the components are listed.
- **Illinois Toxic Substances Disclosure to Employee Act**: None of the components are listed.
- **Louisiana Reporting**: None of the components are listed.
- **Louisiana Spill**: None of the components are listed.
- **Massachusetts Spill**: None of the components are listed.
- **Massachusetts Substances**: The following components are listed: NITROGEN; OXYGEN (LIQUID); CARBON MONOXIDE; METHANE; HYDROGEN SULFIDE
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**Michigan Critical Material**: None of the components are listed.

**Minnesota Hazardous Substances**: None of the components are listed.

**New Jersey Hazardous Substances**: The following components are listed:
- NITROGEN; OXYGEN; CARBON MONOXIDE; METHANE; HYDROGEN SULFIDE

**New Jersey Spill**: None of the components are listed.

**New Jersey Toxic Catastrophe Prevention Act**: The following components are listed:
- Carbon monoxide; Hydrogen Sulfide

**New York Acutely Hazardous Substances**: The following components are listed:
- Hydrogen sulfide

**New York Toxic Chemical Release Reporting**: None of the components are listed.

**Pennsylvania RTK Hazardous Substances**: The following components are listed:
- NITROGEN; OXYGEN; CARBON MONOXIDE; METHANE; HYDROGEN SULFIDE (H2S)

**Rhode Island Hazardous Substances**: None of the components are listed.

**California Prop. 65**

**WARNING**: This product contains a chemical known to the State of California to cause 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>
</table>

**Canada**

**WHMIS (Canada)**

- Class A: Compressed gas.
- Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
- Class D-2A: Material causing other toxic effects (Very toxic).
- Class D-2B: Material causing other toxic effects (Toxic).

**CEPA Toxic substances**: The following components are listed: Methane

**Canadian ARET**: None of the components are listed.

**Canadian NPRI**: The following components are listed: Carbon monoxide; Volatile organic compounds; Hydrogen sulphide

**Alberta Designated Substances**: None of the components are listed.

**Ontario Designated Substances**: None of the components are listed.

**Quebec Designated Substances**: None of the components are listed.

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**Section 16. Other information**

**United States**

**Label requirements**

- MAY BE FATAL IF INHALED.
- MAY CAUSE EYE AND SKIN IRRITATION.
- CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
- CONTENTS UNDER PRESSURE.

**Canada**

**Label requirements**

- Class A: Compressed gas.
- Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
- 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.)**

<table>
<thead>
<tr>
<th>Health</th>
<th>Flammability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

---
Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

National Fire Protection Association (U.S.A.)

**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.