1. IDENTIFICATION

Product identifier
Product Name NITROUS OXIDE

Other means of identification
Safety data sheet number LIND-P090
UN/ID no. UN1070
Synonyms Dinitrogen Monoxide; Laughing Gas; Factitious Air; Hyponitrous Acid Anhydride; Nitrogen(I) Oxide

Recommended use of the chemical and restrictions on use
Recommended Use Industrial and professional use.
Uses advised against Consumer use

Details of the supplier of the safety data sheet
Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC
575 Mountain Ave.
Murray Hill, NJ 07974
Phone: 908-464-8100
www.lindeus.com

Linde Gas Puerto Rico, Inc.
Road 869, Km 1.8
Barrio Palmas, Catano, PR 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-1700
www.lindecanada.com

* May include subsidiaries or affiliate companies/divisions.

For additional product information contact your local customer service.

Emergency telephone number
Company Phone Number 800-232-4726 (Linde National Operations Center, US)
905-501-0802 (Canada)
CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)
2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

| Specific target organ toxicity (single exposure) | Category 3 |
| Oxidizing gases | Category 1 |
| Gases under pressure | Liquefied gas |
| Simple asphyxiants | Yes |

Label elements

Signal word Danger

Hazard Statements
May cause or intensify fire; oxidizer
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation
May cause drowsiness or dizziness
May cause frostbite

Precautionary Statements - Prevention
Do not handle until all safety precautions have been read and understood
Keep and store away from clothing and other combustible materials
Keep valves and fittings free from oil and grease
Avoid breathing gas
Do not get in eyes, on skin, or on clothing
Use and store only outdoors or in a well ventilated place
Use backflow preventive device in piping
Use only equipment of compatible materials of construction and rated for cylinder pressure
Use only with equipment cleaned for oxygen service
Open valve slowly
Close valve after each use and when empty

Precautionary Statements - Response
If INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
If ON SKIN: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention.
In case of fire: Stop leak if safe to do so

Precautionary Statements - Storage
Protect from sunlight when ambient temperature exceeds 52°C/125°F

Hazards not otherwise classified (HNOC)
Not applicable
3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Volume %</th>
<th>Chemical Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td>10024-97-2</td>
<td>100</td>
<td>N\textsubscript{2}O</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

Description of first aid measures

General advice
Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Inhalation
Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Skin contact
For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.

Eye contact
If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.

Ingestion
Not an expected route of exposure.

Self-protection of the first aider
RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Most important symptoms and effects, both acute and delayed

Symptoms
Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death. Central nervous system depression. Contact with liquid may cause cold burns/ frostbite.

Indication of any immediate medical attention and special treatment needed

Note to physicians
Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific extinguishing methods
Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical
May cause or intensify fire; oxidizer. Will support and accelerate combustion of combustible materials (wood, paper, oil, debris, etc). May decompose violently at temperatures above 1112°F (600°C). Cylinders may rupture under extreme heat.
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

Personal precautions, protective equipment and emergency procedures

Personal precautions
- Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas.
- Monitor oxygen level. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Eliminate all ignition sources if safe to do so.

Other Information
- Gas/vapor is heavier than air. Prevent from entering sewers, basements and workpits, or any place where accumulation may be dangerous.

Environmental precautions
- Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Methods and material for containment and cleaning up

Methods for containment
- Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.

Methods for cleaning up
- Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling
- Due to increased misuse and abuse of nitrous oxide, handling and storage precautions should be implemented to prevent theft and improper use. The following recommendations may not include all precautions which are necessary. Nitrous oxide systems should be installed in accordance with CGA G-8.1, "Standard for Nitrous Oxide Systems at Consumer Sites". Keep full and empty nitrous oxide containers and utilization equipment stored in a secured area. Allow only authorized personnel to remove containers, inventory and account for both full and empty containers and bulk product. Promptly report any theft of nitrous oxide to the police and the supplier. Establish other procedures as necessary to check for unusual use or loss of nitrous oxide.
- Keep valves and fittings free from oil and grease. Use only with equipment cleaned for oxygen service. Use only equipment of compatible materials of construction. Open valve slowly. "NO SMOKING" signs should be posted in storage and use areas. Separate flammable gas cylinders from oxygen and other oxidizers by a minimum distance of 20 ft. or by a 5 ft. high barrier with a minimum fire resistance rating of a half an hour.
Protect cylinders from physical damage; do not drag, roll, slide or drop. Never attempt to lift a cylinder by its valve protection cap. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Use only with adequate ventilation. Use backflow preventive device in piping. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers. Use only with equipment rated for cylinder pressure. For additional recommendations, consult Compressed Gas Association's Pamphlet G-8.2 and SB-6.

**Conditions for safe storage, including any incompatibilities**

**Storage Conditions**
Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Use a “first in-first out” inventory system to prevent full cylinders from being stored for excessive periods of time. Full and empty cylinders should be segregated. Do not store near combustible materials. Stored containers should be periodically checked for general condition and leakage.

**Incompatible materials**

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

#### Control parameters

**Exposure Guidelines**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide 10024-97-2</td>
<td>TWA: 50 ppm</td>
<td>-</td>
<td>TWA: 25 ppm over the time exposed to waste anesthetic gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA: 46 mg/m³ over the time exposed to waste anesthetic gas</td>
</tr>
</tbody>
</table>

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health

**Appropriate engineering controls**

**Engineering Controls**
Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages. Showers. Eyewash stations.

**Individual protection measures, such as personal protective equipment**

**Eye/face protection**
Wear safety glasses with side shields (or goggles). If splashes are likely to occur, wear: Goggles. Face-shield.

**Skin and body protection**
Work gloves and safety shoes are recommended when handling cylinders. Wear cold insulating gloves when handling liquid. Gloves must be clean and free from grease or oil.

**Respiratory protection**
Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).
General Hygiene Considerations

Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

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>Compressed gas</td>
</tr>
<tr>
<td>Appearance</td>
<td>Colorless.</td>
</tr>
<tr>
<td>Odor</td>
<td>Slight sweet.</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point</td>
<td>-90.81 °C / -131.5 °F</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td>Yes</td>
</tr>
<tr>
<td>Lower flammability limit:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Water solubility</td>
<td>Slightly soluble</td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>0.4</td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Chemical Name | Molecular weight | Boiling point | Vapor Pressure | Vapor density (air =1) | Gas Density kg/ m³@20°C | Critical Temperature °C |
---------------|------------------|---------------|----------------|------------------------|--------------------------|--------------------------|
Nitrous oxide  | 44.01            | -88.56 °C     | Gas at atmospheric pressure | 1.53                   | 1.95                      | 36.4                      |

10. STABILITY AND REACTIVITY

Reactivity
Not reactive under normal conditions

Chemical stability
Stable under normal conditions.

Explosion data
- Sensitivity to Mechanical Impact: None.
- Sensitivity to Static Discharge: None.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Heat, flames and sparks. Nitrous oxide will serve as the oxidant for most flammable materials. Some flammables will have a lower flammable limit in nitrous oxide than in pure oxygen.

Incompatible materials

Hazardous Decomposition Products
At elevated temperatures, nitrous oxide decomposes into nitrogen and oxygen, the rate of decomposition being appreciable at about 1112°F (600°C). Nitrous oxide exposed to fire or other intense heat source may decompose violently.

11. TOXICOLOGICAL INFORMATION
Information on likely routes of exposure

Inhalation
Anesthetic effects may occur when mixed with oxygen at a ratio of 80% nitrous oxide to 20% oxygen. Laughter effects seem to occur after incipient asphyxia accompanied by the sudden return of oxygen. Nitrous oxide is a slight narcotic. Intentional misuse by deliberately concentrating and inhaling contents may be harmful or fatal. Product is a simple asphyxiant.

Skin contact
Contact with liquid may cause cold burns/ frostbite.

Eye contact
Contact with liquid may cause cold burns/ frostbite.

Ingestion
Not an expected route of exposure.

Information on toxicological effects

Symptoms
Central nervous system depression.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Not classified.

Sensitization
Not classified.

Germ cell mutagenicity
Not classified.

Carcinogenicity
This product does not contain any carcinogens or potential carcinogens listed by OSHA, IARC or NTP.

Chemical Name | ACGIH | IARC | NTP | OSHA
---|---|---|---|---
Nitrous oxide | - | Group 3 | - | -
10024-97-2 | | | | |

IARC (International Agency for Research on Cancer)
Not classifiable as a human carcinogen

Reproductive toxicity
Reproductive toxicity has been observed in humans and animals following exposure to nitrous oxide in concentrations in excess of the TLV. Exposure to nitrous oxide alone resulted in a 50% increase in congenital abnormalities and a 100% increase in spontaneous abortion in female dental assistants compared to nonusers of nitrous oxide.

Developmental Toxicity
Fetal mortality increased at all concentrations in pregnant rats exposed to 0, 100, 1000, or 15,000 ppm nitrous oxide (8 or 24 H/ day for 5-9 days, 2-3 week of pregnancy) and teratogenic effects (skeletal abnormalities) were seen at 1000 ppm.

STOT - single exposure
Category 3. Central nervous system.

STOT - repeated exposure
Not classified.

Chronic toxicity
Possible risk of irreversible effects. Prolonged or repeated exposure increases the risk. Contains a known or suspected reproductive toxin.

Target Organ Effects
Central nervous system, Reproductive System, Respiratory system.

Neurological effects
Neurological impairment from nitrous oxide exposure has been reported at concentrations of several hundred to several thousand ppm; however, decrements in human cognitive and psychomotor functions have been reported at much lower concentrations. Dentists exposed to nitrous oxide longer than 3000 hours within the prior 10 years exhibited neurologic symptoms such as weakness, tingling and numbness.

Aspiration hazard
Not applicable.

Numerical measures of toxicity

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
<th>Inhalation LC50 (CGA P-20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td></td>
<td></td>
<td>&gt;250 ppm ( Rat ) 4 h</td>
<td></td>
</tr>
<tr>
<td>10024-97-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Product Information

Oral LD50
No information available

Dermal LD50
No information available

Inhalation LC50
No information available

The following values are calculated based on chapter 3.1 of the GHS document.
12. ECOLOGICAL INFORMATION

Ecotoxicity
No known acute aquatic toxicity.

Persistence and degradability
Not applicable.

Bioaccumulation
No information available.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Partition coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td>10024-97-2</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>

Global warming potential (GWP) 298

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes
Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.

14. TRANSPORT INFORMATION

DOT

<table>
<thead>
<tr>
<th>UN/ ID no.</th>
<th>Proper shipping name</th>
<th>Hazard Class</th>
<th>Subsidiary class</th>
<th>Special Provisions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1070</td>
<td>Nitrous oxide</td>
<td>2.2</td>
<td>5.1</td>
<td>A14</td>
<td>UN1070, Nitrous oxide, 2.2 (5.1)</td>
</tr>
</tbody>
</table>

Emergency Response Guide Number 122

TDG

<table>
<thead>
<tr>
<th>UN/ ID no.</th>
<th>Proper shipping name</th>
<th>Hazard Class</th>
<th>Subsidiary class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1070</td>
<td>Nitrous oxide</td>
<td>2.2</td>
<td>5.1</td>
<td>UN1070, Nitrous oxide, 2.2 (5.1)</td>
</tr>
</tbody>
</table>

MEX

<table>
<thead>
<tr>
<th>UN/ ID no.</th>
<th>Proper shipping name</th>
<th>Hazard Class</th>
<th>Subsidiary class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1070</td>
<td>Nitrous oxide</td>
<td>2.2</td>
<td>5.1</td>
<td>UN1070, Nitrous oxide, 2.2 (5.1)</td>
</tr>
</tbody>
</table>

IATA

<table>
<thead>
<tr>
<th>UN/ ID no.</th>
<th>Proper shipping name</th>
<th>Hazard Class</th>
<th>Subsidiary hazard class</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1070</td>
<td>Nitrous oxide</td>
<td>2.2</td>
<td>5.1</td>
</tr>
</tbody>
</table>
LIND-P090 NITROUS OXIDE

ERG Code 2AX
Description UN1070, Nitrous oxide, 2.2 (5.1)

IMDG
UN/ID no. UN1070
Proper shipping name Nitrous oxide
Hazard Class 2.2
Subsidiary hazard class 5.1
EmS-No. F-C, S-W
Description UN1070, Nitrous oxide, 2.2 (5.1)

ADR
UN/ID no. UN1070
Proper shipping name Nitrous oxide
Hazard Class 2.2
Classification code 20
Tunnel restriction code (C/E)
Special Provisions 584
Description UN1070, Nitrous oxide, 2.2 (5.1), (C/E)
Labels 5.1

15. REGULATORY INFORMATION

International Inventories
TSCA Complies
DSL Complies
EINECS/ELINCS Complies

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/ European List of Notified Chemical Substances

US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories
Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard Yes
Sudden release of pressure hazard Yes
Reactive Hazard No

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)
Risk and Process Safety Management Programs
This material, as supplied, does not contain any regulated substances with specified thresholds under 40 CFR Part 68. This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

US State Regulations
California Proposition 65
This product contains the following Proposition 65 chemicals

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>California Proposition 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide - 10024-97-2</td>
<td>Developmental</td>
</tr>
<tr>
<td></td>
<td>Female Reproductive</td>
</tr>
</tbody>
</table>

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10024-97-2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

International Regulations

16. OTHER INFORMATION

<table>
<thead>
<tr>
<th>NFPA Health hazards</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical and Chemical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>OX</td>
</tr>
</tbody>
</table>

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

Issue Date          06-Mar-2015
Revision Date        06-Mar-2015
Revision Note        Initial Release.

General Disclaimer
For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user’s intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

End of Safety Data Sheet