



SULFUR DIOXIDE

Safety Data Sheet

1. IDENTIFICATION

Product identifier

Product Name SULFUR DIOXIDE

Other means of identification

Safety data sheet number LIND-P111

UN / ID no. UN1079

Synonyms Bisulfite; Sulfurous Anhydride; Sulfurous Oxide; Sulfur Oxide; Sulphur Dioxide

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

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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

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Linde Canada Limited

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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).

Acute toxicity - Inhalation (Gases)	Category 3
Skin corrosion / irritation	Category 1 Sub-category B
Serious eye damage / eye irritation	Category 1
Gases under pressure	Liquefied gas

Label elements

Signal word

Danger

Hazard Statements

Contains gas under pressure; may explode if heated

Toxic if inhaled

Causes severe skin burns and eye damage

Corrosive to the respiratory tract

Precautionary Statements - Prevention

Do not handle until all safety precautions have been read and understood

Avoid breathing gas

Do not get in eyes, on skin, or on clothing

Use and store only outdoors or in a well ventilated place

Wear protective gloves, protective clothing, eye protection, respiratory protection, and / or face protection

Use a backflow preventive device in piping

Use only with equipment of compatible materials of construction and rated for cylinder pressure

Do not open valve until connected to equipment prepared for use

Close valve after each use and when empty

When returning cylinder, install leak tight valve outlet cap or plug

Precautionary Statements - Response

IF INHALED: Remove person to fresh air and keep comfortable for breathing. 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. Wash contaminated clothing before reuse. 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

Precautionary Statements - Storage

Store locked up

Protect from sunlight when ambient temperature exceeds 52°C / 125°F

Precautionary Statements - Disposal

Dispose of contents / containers in accordance with container supplier / owner instructions

Hazards not otherwise classified (HNOC)

Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Volume %	Chemical Formula
Sulfur dioxide	7446-09-5	100	SO ₂

4. FIRST AID MEASURES

Description of first aid measures

General advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
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. Any physical exertion during this period should be discouraged as it may increase the severity of the pulmonary edema or chemical pneumonitis. Bed rest is indicated.
Skin contact	Immediately flush skin with plenty of water for at least 30 minutes. Remove contaminated clothing and shoes. Immediate medical attention is required.
Eye contact	Immediately flush eyes with running water for at least 30 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area. Immediate medical attention is required.
Ingestion	Not an expected route of exposure.
Self-protection of the first aider	RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Use personal protective equipment. Avoid contact with skin, eyes and clothing.

Most important symptoms and effects, both acute and delayed

Symptoms	Inhalation of corrosive fumes / gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Chemical pneumonitis and pulmonary edema result from exposure to the lower respiratory tract and deep lung. Residual pulmonary malfunction might occur. May cause burns of eyes, skin and mucous membranes.
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Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.
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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

Non-flammable gas. Sulfur dioxide reacts with water to form sulfuric acid. The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating and toxic gases and vapors. 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. Corrosive hazard. Wear chemically protective gloves / clothing and eye / face protection.

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. Keep people away from and upwind of spill / leak. Monitor concentration of released product. Use personal protection recommended in Section 8. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
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

Environmental precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not allow into any sewer, on the ground or into any body of water. Prevent product from entering drains. See Section 12 for additional ecological information.
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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	Most metals corrode when in contact with wet sulfur dioxide. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never attempt to lift a cylinder by its valve protection cap. 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 a backflow preventive device in piping. Use only with adequate ventilation. Use only with equipment rated for cylinder pressure. 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. For additional storage recommendations, consult Compressed Gas Association's Pamphlets G-3, and TB-11.
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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. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Stored containers should be periodically checked for general condition and leakage.
Incompatible materials	Metal oxides. Alkalies.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sulfur dioxide 7446-09-5	STEL: 0.25 ppm	TWA: 5 ppm TWA: 13 mg / m ³ (vacated) TWA: 2 ppm (vacated) TWA: 5 mg / m ³ (vacated) STEL: 5 ppm (vacated) STEL: 15 mg / m ³	IDLH: 100 ppm TWA: 2 ppm TWA: 5 mg / m ³ STEL: 5 ppm STEL: 13 mg / m ³

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

Other Information	Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).
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Appropriate engineering controls

Engineering Controls	Showers. Eyewash stations. Ventilation systems. Exhaust gas should be vented to a gas treatment system. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages.
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Individual protection measures, such as personal protective equipment

Eye / face protection	Tightly fitting safety goggles. Face protection shield.
Skin and body protection	Appropriate protective and chemical resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction consult protective clothing manufacturer's specifications. (Saranex® and Barricade® are effective for exposures greater than 8 hours). Work gloves and safety shoes are recommended when handling cylinders.
Respiratory protection	If exposure limits are exceeded or irritation is experienced, NIOSH / MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing before re-use. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Compressed gas
Appearance	Colorless.

Odor	Pungent.
Odor threshold	No information available
pH	If dissolved in water, will affect pH value
Melting point	-75.5 °C / -103.9 °F
Evaporation rate	Not applicable
Lower flammability limit:	Not applicable
Upper flammability limit:	Not applicable
Flash point	No information available
Autoignition temperature	No data available
Decomposition temperature	No data available
Water solubility	Soluble in water.
Partition coefficient	No data available
Kinematic viscosity	Not applicable

Chemical Name	Molecular weight	Boiling point	Vapor Pressure	Vapor density (air =1)	Gas Density kg / m ³ @20°C	Critical Temperature
Sulfur dioxide	64.06	-10 °C	3200 hPa @ 20 °C	2.26	2.697	157.4 °C

10. STABILITY AND REACTIVITY

Reactivity

Not reactive under normal conditions

Chemical stability

Stable under recommended storage conditions.

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of Hazardous Reactions

None under normal processing.

Conditions to avoid

Sulfur dioxide reacts violently with peroxides, chromates, bichromates, permanganates, and oxygen difluoride. It also reacts with chlorates to form chlorine, which may become explosive at elevated temperatures. Forms sulfuric acid in contact with water.

Incompatible materials

Metal oxides. Alkalis.

Hazardous Decomposition Products

Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	The irritant actions of sulfur dioxide is believed to be caused by the formation of sulfuric acid when the gas dissolves. Bronchoconstriction caused by sulfur dioxide is concentration related. Fifteen humans which inhaled 1,5, or 25 ppm for 6 hours (nose-breathing) exhibited reduced forced expiratory volume and forced expiratory flow at all concentrations. Significant reduction in nasal mucous flow rate was seen following exposure to 5 or 25 ppm. Corrosive to respiratory system.
Skin contact	Corrosive. Causes severe irritation and or burns.
Eye contact	Corrosive to the eyes and may cause severe damage including blindness.
Ingestion	Not an expected route of exposure.

Information on toxicological effects

Symptoms May be fatal if inhaled. Inhalation of corrosive fumes / gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate.

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

Skin corrosion / irritation Category 1B.
Serious eye damage / eye irritation Category 1.
Irritation Sulfur dioxide can cause irritation at relatively low levels (1-5 ppm); however workers may become acclimated even to initially unbearable concentrations (25 ppm). Pure sulfur dioxide may damage the skin, eyes, and mucous membranes.
Sensitization Not classified.
Germ cell mutagenicity Not classified. Sulfur dioxide has failed consistently to induce genotoxicity in intact rodents.
Carcinogenicity Sulfur dioxide may act as a promotor. Substantial increase in respiratory tract squamous cell carcinomas was reported in rats following exposure to benzo[a]pyrene and sulfur dioxide at 4 or 10 ppm (1-6 H / day, 5 days / week) compared to carcinomas resulting from exposure to sulfur dioxide or benzo[a]pyrene alone. The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Sulfur dioxide 7446-09-5	-	Group 3	-	-

IARC (International Agency for Research on Cancer)

Not classifiable as a human carcinogen

Reproductive toxicity Not classified. Experimental inhalation exposures of rats and mice at 1.5 to 32 ppm resulted in toxicity to both male and female reproductive systems. Effects included menstrual cycle changes and toxic effects to testes.

Developmental Toxicity May be a developmental hazard based on animal data.

STOT - single exposure Not classified.

STOT - repeated exposure Not classified.

Chronic toxicity Repeated exposure to sulfur dioxide has caused thickening of the mucousal layer in the trachea and increases the goblet cells and mucous glands in test animals indicating the potential for chronic respiratory disease in humans. Dogs exposed continuously for 225 days to 5 ppm exhibited decreased lung compliance and increased pulmonary flow-resistance. Chronic exposure to corrosive fumes / gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen.

Target Organ Effects Respiratory system, Eyes, Skin.

Aspiration hazard Not applicable.

Numerical measures of toxicity

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50	Inhalation LC50 (CGA P-20)
Sulfur dioxide 7446-09-5	-	-	-	2520 ppm (Rat) 1hr

Product Information

Oral LD50 No information available
Dermal LD50 No information available
Inhalation LC50 No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic organisms. May cause pH changes in aqueous ecological systems.

Persistence and degradability

Not applicable.

Bioaccumulation

No information available.

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

UN / ID no.	UN1079
Proper shipping name	Sulfur dioxide
Hazard Class	2.3
Subsidiary class	8
Special Provisions	3, B14, T50, TP19
Description	UN1079, Sulfur dioxide, 2.3 (8)
Additional Description:	"Toxic-Inhalation Hazard Zone C"
Additional Marking Requirements:	"Inhalation Hazard"
Emergency Response Guide Number	125

UN / ID no.	UN1079
Proper shipping name	Sulfur dioxide
Hazard Class	2.3
Subsidiary class	8
Description	UN1079, Sulfur dioxide, 2.3 (8)

MEX

UN / ID no.	UN1079
Proper shipping name	Sulphur dioxide
Hazard Class	2.3
Subsidiary class	8
Description	UN1079, Sulphur dioxide, 2.3 (8)

IATA

Forbidden

IMDG

UN / ID no.	UN1079
Proper shipping name	Sulphur dioxide
Hazard Class	2.3
Subsidiary hazard class	8
EmS-No.	F-C, S-U
Description	UN1079, Sulphur dioxide, 2.3 (8)

ADR

UN / ID no.	UN1079
Proper shipping name	Sulphur dioxide
Hazard Class	2.3 8
Classification code	2TC
Tunnel restriction code	(C/D)

Description UN1079, Sulphur dioxide, 2.3 8, (C/D)
Labels 2.3 + 8

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
DSL / NDSL 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 No
Sudden release of pressure hazard Yes
Reactive Hazard No

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).

Chemical Name	Hazardous Substances RQs	CERCLA / SARA RQ	Reportable Quantity (RQ)
Sulfur dioxide 7446-09-5	-	500 lb	-

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, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

Chemical Name	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances	U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
Sulfur dioxide	5000 lb		1000 lb

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical Name	California Proposition 65
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Sulfur dioxide - 7446-09-5	Developmental
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U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Sulfur dioxide 7446-09-5	X	X	X

International Regulations

Chemical Name	Carcinogenicity	Exposure Limits
Sulfur dioxide		Mexico: TWA 2 ppm Mexico: TWA 5 mg / m ³ Mexico: STEL 5 ppm Mexico: STEL 10 mg / m ³

Chemical Name	NPRI
Sulfur dioxide	X

Legend

Canada NPRI - National Pollutant Release Inventory

16. OTHER INFORMATION

NFPA Health hazards 3 Flammability 0 Instability 0 Physical and Chemical
Properties -

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 25-Apr-2015
Revision Date 25-Apr-2015
Revision Note Not applicable.

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

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End of Safety Data Sheet