

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Sulfur dioxide (MSDS No. P-4655-E)		Trade Name: Sulfur Dioxide
Chemical Name: Sulfur dioxide		Synonyms: Refrigerant gas R764, sulfur oxide, sulfurous acid anhydride, sulfurous anhydride, sulfurous oxide
Formula: SO ₂		Chemical Family: Sulfur bearing
Telephone:	Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR	Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113

* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Composition/Information on Ingredients

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV (2004)
Sulfur Dioxide	7446-09-5	>99%*	5 ppm	2 ppm**

* The symbol > means "greater than."

** See section 3.

3. Hazards Identification



EMERGENCY OVERVIEW

**DANGER! Toxic, corrosive liquid and gas under pressure.
Harmful if inhaled.**



**Can cause eye, skin, and respiratory tract burns.
Self-contained breathing apparatus must be worn by rescue workers.
Odor: Choking above 3-5 ppm**

THRESHOLD LIMIT VALUE: 2 ppm TWA, 5 ppm TWA-STEEL (15 min.) (ACGIH, 2004). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION—Exposure to concentrations above the TLV of 2 ppm may irritate the eyes, nose, throat, sinuses, with choking, coughing, and sometimes bronchoconstriction. Concentrations of 50-100 ppm are considered dangerous, and exposures of 400-500 ppm are immediately life-threatening. Exposure to high concentrations may result in pulmonary edema and paralysis. Lack of oxygen can kill.

SKIN CONTACT—Liquid sulfur dioxide is a severe irritant and may cause chemical burns. With prolonged or widespread skin contact, the skin may absorb potentially harmful amounts of material.

SWALLOWING—An unlikely route of exposure. This product is a gas at normal temperature and pressure. Highly toxic. May cause chemical burns of the mouth, esophagus, and stomach.

EYE CONTACT—Vapor may irritate the eyes and cause conjunctival inflammation. Liquid may cause corneal burns and opacification with loss of vision.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Chronic overexposure by inhalation may cause chronic bronchitis with emphysema and impaired pulmonary function. The pulmonary effects are increased in the presence of respirable particles. May cause respiratory irritation and some nosebleeds. Repeated skin exposure may cause dermatitis. Repeated exposure to low concentrations may cause systemic acidosis.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease. Skin contact may aggravate an existing dermatitis.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: None known.

CARCINOGENICITY: Sulfur dioxide is not listed by NTP or OSHA. The IARC lists it in Group 3, Unclassifiable as to carcinogenicity to humans.

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. Rescuer should avoid breathing air exhaled by victim. If breathing is difficult, qualified personnel may give oxygen. Keep patient warm. Call a physician.

SKIN CONTACT: Immediately flush skin with plenty of water while removing contaminated clothing and shoes. Discard clothing and shoes. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure. If liquid is swallowed, rinse mouth with water. Give at least two glasses of water or milk. Do not induce vomiting. Call a physician.

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. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *Keep victims of exposure under medical observation for at least 72 hours to observe for pulmonary edema.*

The hazards of this material are mainly due to its severe irritant and corrosive properties. Injury occurs to the skin and to mucosal surfaces. There is no specific antidote; direct treatment to control of symptoms and clinical condition.

5. Fire Fighting Measures

FLASH POINT (test method):	Not applicable	
AUTOIGNITION TEMPERATURE:	Not applicable	
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: Not applicable	UPPER: Not applicable
EXTINGUISHING MEDIA: Sulfur dioxide cannot catch fire. Use media appropriate for surrounding fire.		

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, corrosive liquid and gas under pressure (see section 3). Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool cylinders with water spray from maximum distance; then move them away from fire if without risk. If cylinders are leaking, reduce toxic vapors with water spray or fog. Shut off leak if without risk. Reverse flow into cylinders may cause rupture. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Nonflammable, toxic, corrosive gas. Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Sulfur dioxide cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) Vapors are extremely irritating and may burn skin and eyes on contact.

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, corrosive liquid and gas under pressure (see section 3). Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus and protective clothing where needed. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Prevent runoff from contaminating surrounding environment. Toxic, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device. Reverse flow into cylinder may cause rupture.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. 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. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using sulfur dioxide, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—A corrosion-resistant system is acceptable.

MECHANICAL (general)—Inadequate. See SPECIAL, below.

SPECIAL—Use only in a closed system. A corrosion-resistant, forced-draft fume hood is preferred.

OTHER—See special.

RESPIRATORY PROTECTION: Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

SKIN PROTECTION: Neoprene

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling and protective clothing where needed. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	64.06
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	2.2638
GAS DENSITY at 32°F (0°C) and 1 atm:	0.1827 lb/ft ³ (2.927 kg/m ³)
VAPOR PRESSURE at 70°F (21.1°C):	49.1 psia (338.5 kPa abs)
SOLUBILITY IN WATER , % by wt:	Appreciable; forms sulfurous acid.
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1):	High
BOILING POINT at 1 atm:	14°F (-10°C)
FREEZING POINT at 1 atm:	-104.6°F (-75.9°C)
APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; choking odor above 3-5 ppm.	

10. Stability and Reactivity**STABILITY:**☐ Unstable☒ Stable

INCOMPATIBILITY (materials to avoid): Chlorine trifluoride, chlorates, sodium carbide, powdered aluminum, moisture, zinc and its alloys, manganese, alkali metals, metal nitrates, rubidium carbide, sodium, ferrous oxide at 572°F (300°C), fluorine, stannous oxide, metal acetylides, metal oxides, metal hydrides, and acrolein.

HAZARDOUS DECOMPOSITION PRODUCTS: None known.

HAZARDOUS POLYMERIZATION:☐ May Occur☒ Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

LC₅₀ = 2520 ppm, 1 hr, rat. See section 3.

12. Ecological Information

Sulfur dioxide does not contain any Class I or Class II ozone-depleting chemicals. Sulfur dioxide is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not dispose of unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Sulfur dioxide

HAZARD

CLASS: 2.3

IDENTIFICATION

NUMBER: UN 1079

PRODUCT

RQ: None

SHIPPING LABEL(s): POISON GAS, CORROSIVE*

PLACARD (when required): POISON GAS, CORROSIVE*

* The words in the POISON GAS diamond are INHALATION HAZARD.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Additional Marking: INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:**EPA (ENVIRONMENTAL PROTECTION AGENCY)**

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: 500 lb (226.8 kg)

EHS RQ: 500 lb (226.8 kg)

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: Yes

REACTIVITY: No

FIRE: No

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Sulfur dioxide does not require reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Sulfur dioxide is listed as a regulated substance in quantities of 5000 lb (2268 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Sulfur dioxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Sulfur dioxide is listed in Appendix A as a highly hazardous chemical in quantities of 1000 lb (454 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: This product is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Toxic, corrosive liquid and gas under pressure.* Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. Use piping

and equipment adequately designed to withstand pressures to be encountered. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***Store and use with adequate ventilation at all times.*** Always secure cylinder prior to use. Use only in a closed system constructed of corrosion-resistant materials. Close valve after each use; keep closed even when empty. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. ***Follow safe practices when returning cylinder to supplier.*** Be sure valve is closed; then install valve outlet plug tightly. ***Do not allow cylinder to stand in water. Never place a compressed gas cylinder where it may become part of an electrical circuit.***

NOTE: Prior to using any plastics, confirm their compatibility with sulfur dioxide.

Recommended Equipment: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

MIXTURES: When you mix two or more gases or liquefied gases, 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. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH	= 3
FLAMMABILITY	= 0
INSTABILITY	= 0
SPECIAL	= None

HMIS RATINGS:

HEALTH	= 3
FLAMMABILITY	= 0
PHYSICAL HAZARD	= 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:

CGA-660 connection is standard.

PIN-INDEXED YOKE:

Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION:

Not assigned. (CGA-634 is the tentative selection where applicable.)

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlets V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

P-1	<i>Safe Handling of Compressed Gases in Containers</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

Praxair asks users of this product to study this MSDS and become aware of 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 MSDS 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 Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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