

**Sulfur Dioxide****1. PRODUCT AND COMPANY IDENTIFICATION**

**Product Name:** Sulfur Dioxide      **Formula:** SO<sub>2</sub>      **Molecular Weight:** 64.06  
**Chemical Name:** Sulfur Dioxide      **Chemical Family:** Acidic Anhydride      **CAS#** 7446-09-5  
**Synonyms:** Sulfurous (Acid) Anhydride, Sulfurous Oxide, Sulphur Dioxide  
**Product Use:** Used as a bleaching agent, refrigerant, solvent and in processing food products.

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**2. COMPOSITION/INFORMATION ON INGREDIENTS**

	% by Wt.	CAS Number
Sulfur Dioxide	99-100%	7446-09-5

**3. HAZARD INFORMATION****EMERGENCY OVERVIEW:**

**Danger! Poisonous Compressed Gas.** May be fatal if inhaled. Extremely irritating to eyes and respiratory tract. Causes lung injury. Effects may be delayed. Liquid may cause frostbite. Not flammable.

Sulfur Dioxide is a colorless gas or liquid under pressure with a strong pungent odor.

**National Fire Protection Association (NFPA) Rating**  
**Hazardous Materials Identification System (HMIS) Rating**

	NFPA	HMIS
HEALTH	3	3
FIRE	0	0
REACTIVITY	0	0
SPECIAL		

4 = Extreme/Severe

3 = High/Serious

2 = Moderate

1 = Slight

0 = Minimum

W = Water Reactive



# MATERIAL SAFETY DATA SHEET

## Sulfur Dioxide

### 3. HAZARD INFORMATION (continued)

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#### Δ Exposure Limits:

	ACGIH (TLV)	OSHA (PEL)	NIOSH (IDLH)
Δ Sulfur Dioxide	2 ppm , 5.2 mg/m <sup>3</sup> (TWA) 5ppm, 13 mg/m <sup>3</sup> (STEL)	5 ppm (13 mg/m <sup>3</sup> ) (TWA)	100 ppm

#### POTENTIAL HEALTH EFFECTS:

**Skin Contact:** Liquid sulfur dioxide can cause frostbite and skin burns. Sulfur Dioxide converts to sulfurous acid in moist environments, which may cause skin irritation.

**Eye Contact:** Mildly irritating at low concentrations of 5.4 ppm. Moderate to severe irritation above 8 ppm. Liquid sulfur dioxide can burn the eye and permanently affect vision.

**Inhalation:** Vapors are extremely irritating to throat, mucous membranes and upper respiratory tract. Short exposures to concentrations as low a 1 ppm may produce a reversible decrease in lung function. Concentrations as low as 5 ppm have produced constriction of the bronchiole tubes. Severe overexposure may result in pulmonary edema, permanent lung injury or death. The effects of pulmonary edema which include coughing and shortness of breath may be delayed for hours or days after exposure.-

**Ingestion:** Not applicable. Since material is a gas at room temperature, ingestion is unlikely to occur.

**Long Term Exposure:** Dental caries, loss of fillings, gum disorders and the rapid and painless destruction of teeth may result from over-exposure.

Corrosive effects on the skin, eyes and lungs, may be delayed, and damage may occur without the sensation or onset of pain. Repeated overexposure may lead to contact dermatitis, may cause bronchitis with cough, phlegm, shortness of breath and emphysema, chronic runny nose, tearing of the eyes, nosebleeds and stomach upsets. Strict adherence to first aid measures following any exposure is essential.

**Existing Medical Conditions Possibly Aggravated By Exposure:** Skin irritation may be aggravated in individuals with existing skin lesions. Persons subject to asthmatic attacks may experience asthmatic paroxysm. Any disorder inhibiting nasal respiration or any cardiovascular disease may preclude exposure to sulfur dioxide.

**Carcinogenicity Data:** Sulfur Dioxide is not classified by NTP (National Toxicology Program), not regulated as carcinogenic by OSHA (Occupational Safety and Health Administration), or ACGIH (American Conference of Governmental Industrial Hygienists). IARC (International Agency for Research on Cancer) has evaluated sulfur dioxide and concluded that there is inadequate evidence for the carcinogenicity in humans of sulfur dioxide.

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**4. FIRST AID MEASURES**

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**Precaution:** Sulfur Dioxide converts to Sulfurous Acid in moist environments, which may cause skin and eye irritation or corrosion.

**Skin Contact:** For liquid, flush skin with running water for a **minimum** of 20 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Treat frostbite by immediately immersing affected area in warm water until the skin has warmed up and turned pink. Obtain medical attention IMMEDIATELY.

**Eye Contact:** Immediately flush eyes with lukewarm, running water for a **minimum** of 5 minutes for the gas or 20 minutes for the liquid. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY.

**Inhalation:** Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give Cardiopulmonary Resuscitation (CPR) only if there is no pulse AND no breathing. Oxygen may be beneficial and should be administered by trained personnel. Obtain medical attention IMMEDIATELY.

**Ingestion:** Ingestion is not an applicable route of exposure for gases.

**Note to Physician:** Effects of contact or inhalation may be delayed. Provide general supportive measures. Oxygen may be beneficial.

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**5. FIRE FIGHTING MEASURES**

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**Flash Point:** Not applicable, product is non-flammable

**Autoignition Temperature:** Not combustible

**Flammability Limits in air (%):** UEL: Not applicable LEL: Not applicable

**Fire Extinguishing Media:** Use appropriate media to extinguish source of fire.

**Special Fire Fighting Procedures:** Remove sulfur dioxide containers from fire zone if possible. Apply water to cool containers unless there is a sulfur dioxide leak. In presence of sulfur dioxide, use self-contained breathing apparatus and full protective clothing. Gas tight suits are required in extreme (>1000 ppm) concentrations of sulfur dioxide. Evacuate residents who are downwind of fire. Prevent unauthorized entry to fire area. Dike area to contain runoff and prevent contamination of water sources. Neutralize runoff with lime, soda ash or other suitable neutralizing agents (see Deactivating Chemicals, Section 6). Cool containers that are exposed to flame with streams of water until fire is out.

**Other Fire or Explosion Hazards:** Sulfur dioxide is not explosive. Cylinders and ton containers will vent through the fusible plug at 71°C (160°F). Tank cars and tank trucks are fitted with safety relief valves and will vent at 1,550 kPa (225 psig) or 944 kPa (137 psig) in a fire or when unduly high pressure is applied.

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**6. ACCIDENTAL RELEASE MEASURES**

**Steps to be taken in the event of a spill or leak:** Ensure clean-up is conducted by trained personnel. Wear adequate respiratory protective equipment and other personal protective equipment, as required. Restrict access until completion of clean-up. Move unprotected personnel upwind. If a sulfur dioxide container is leaking, try to position it so that gas, rather than liquid, leaks. Using full protective equipment, apply emergency sealing device if possible. Cover leak area with tarpaulin or plastic sheet to limit spread of sulfur dioxide. Leaking sulfur dioxide containers should never be immersed in water. Prevent material from entering waterways, sewers or confined spaces.

**Deactivating Chemicals:** Dilute solutions of soda ash ( $\text{Na}_2\text{CO}_3$ ); caustic soda (weak  $\text{NaOH}$ ); hydrated lime ( $\text{Ca}(\text{OH})_2$ ); sodium bicarbonate ( $\text{NaHCO}_3$ ). Maintain alkaline pH during neutralization. Alkaline solutions must be oxidized (e.g.,  $\text{H}_2\text{O}_2$ ) before disposal due to their oxygen demand.

**Waste Disposal Methods:** Dispose of waste material at an approved waste treatment/disposal facility, in accordance with applicable regulations. Do not dispose of waste with normal garbage or to sewer systems.

Note - Clean-up material may be a RCRA Hazardous Waste on disposal.

- Spills are subject to CERCLA reporting requirements: RQ = 100 lbs.

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**7. HANDLING AND STORAGE**

**Handling Procedures and Equipment:** As a compressed gas, sulfur dioxide must be handled carefully in pressurized containers. Carbon steel meeting the required ASTM specifications is acceptable provided the sulfur dioxide is dry. Suitable relief mechanisms must be installed to protect against equipment rupture.

**Storage Temperature:** Storage temperature should be at or around normal room temperature. Maintain temperature such that the resultant vapor pressure is lower than the relief setting.

**Storage Requirements:** Dry sulfur dioxide is stored in registered steel pressure vessels. Store cylinders in a cool, dry, well ventilated fireproof area away from flammable and corrosive atmospheres. Store away from heat sources. Inspect periodically for damage or leaks.

**Other Precautions:** Segregate from combustible material. Keep quantities stored as small as possible. This material is heavier than air. Leaked gas can accumulate in low areas. Do not store below ground level.

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**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

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Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your work place.

**Engineering Controls:** Local exhaust ventilation required. Use a corrosion proof ventilation system separate from other exhaust systems. Safety shower and eyewash should be proximal to work area.

**Respiratory Protection:** A NIOSH/MSHA approved air-purifying respirator equipped with acid gas/fume, dust, mist cartridges for concentrations up to 20 ppm. A powered air-purifying respirator with acid gas cartridges up to 50 ppm. A full-facepiece air-supplied respirator if concentrations are up to and higher than 100 ppm.

**Skin Protection:** Acid resistant, heavyweight coveralls, safety boots and insulated impervious (i.e., neoprene, PVC) gloves.

**Recommended Materials:** Guidelines for sulfur dioxide:

- (Resistance to breakthrough longer than 8 hours): Saranex (TM), Barricade (TM), Responder (TM).
- (Resistance to breakthrough longer than 4 hours): Teflon (TM).

NOT RECOMMENDED for use (resistance to breakthrough less than 1 hour: Polyethylene

**Eye Protection:** Tight-fitting chemical goggles and face shield.

**Other Personal Protective Equipment:** Impervious gas-tight overall body protection depending on exposure. Safety showers and eyewash fountains should be installed in an area not likely to be affected by a release of sulfur dioxide and near storage and handling areas. Insulated gloves should be worn if liquid contact is anticipated.

**EXPOSURE GUIDELINES:****HAZARDOUS INGREDIENT(S):**

	<b>Sulfur Dioxide:</b>		
	ACGIH TLV	2 ppm	5.2 mg/m <sup>3</sup> (TWA)
	ACGIH STEL	5 ppm	13 mg/m <sup>3</sup>
Δ	OSHA PEL	5 ppm	13 mg/m <sup>3</sup> (TWA)
	NIOSH Immediately Dangerous to Life and Health Level (IDLH)		100 ppm (IDLH)

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**9. PHYSICAL AND CHEMICAL PROPERTIES**

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**Molecular Weight:** 64.06

**Physical State:** Liquefied compressed gas.

**Appearance and Odor:** Colorless gas or liquid with a strong pungent odor.

**Odor Threshold:** 0.5 ppm.

**Boiling Point:** -10°C (14°F) at 760 mmHg.

**Melting/Freezing Point:** -75.9°C (-104.6°F)

**Vapor Pressure at 20°C (68°F):** 2475 mmHg/330 kPa/47.8 psig.

**Specific Gravity at 0°C (32°F):** 1.436

**Vapor Density:** 2.926 g/L at 0°C (32°F) and 760 mmHg.

**Bulk Density:** Not applicable (see specific gravity)

**Evaporation Rate:** 40.18 g/m<sup>2</sup>/s at 21°C (70°F), 16 km/hr wind speed (calc).

**Solubility:** 11.9% by wt. in water at 15°C (60°F) and 760 mmHg. Also soluble in alcohol, chloroform, ether, acetic acid.

**% Volatile by Volume:** 100%

**pH:** Not applicable at 100%. Acidic when dissolved in water (less than 3).

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**10. STABILITY AND REACTIVITY**

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**Stability:**

Under Normal Conditions: Stable.

Under Fire Conditions: Stable.

**Conditions to Avoid:** Avoid exposure to moisture and high temperatures.

**Materials to Avoid:** Moist gas corrodes most metals. Reacts with water. Reacts violently with strong alkalis, bromine pentafluoride, chlorine trifluoride, powdered metals, sodium hydride, cesium azide, silver azide and diethyl zinc.

**Corrosivity to Metals:** Anhydrous sulfur dioxide is non-corrosive to steel and other common metals. If water is present, it can corrode zinc and most common metals.

**Hazardous Decomposition or Combustion Products:** Will form sulfur trioxide and sulfurous acid, which will rapidly convert to sulfuric acid.

**Hazardous Polymerization:** Will not occur

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**11. TOXICOLOGICAL INFORMATION**

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**Toxicological Data:** LC<sub>50</sub> (inhalation, rat) = 2520 ppm for 1 hr.  
Skin effects (rabbit): Mild to Moderate irritation  
Eye effects (rabbit): Mild to Severe irritation

**Carcinogenicity Data:** Sulfur Dioxide is not classified by NTP (National Toxicology Program), not regulated as carcinogenic by OSHA (Occupational Safety and Health Administration), ACGIH (American Conference of Governmental Industrial Hygienists).

IARC (International Agency for Research on Cancer) has evaluated sulfur dioxide and concluded there is inadequate evidence of carcinogenicity in man and limited evidence for carcinogenicity in experimental animals. Their overall evaluation is that sulfur dioxide is not classifiable as to its carcinogenicity to humans.

**Reproductive Effects:** A number of epidemiological studies have suggested that exposure to SO<sub>2</sub> may be related to adverse reproductive effects. However, it is not clear that SO<sub>2</sub> caused the effects observed in any of these studies. There are no relevant results from animal studies.

**Mutagenicity Data:** SO<sub>2</sub> and its aqueous forms gave both positive and negative results in bacterial tests. It did not induce sister chromatid exchange (SCE), chromosomal aberrations or micronucleus formation in the bone marrow of mice or Chinese hamsters in in-vivo tests. However, it induced morphological transformation of Syrian hamster embryo cells (in-vitro). Bisulfite induced both transformation and SCE, but not gene mutation, chromosomal aberrations or DNA repair synthesis in cultured mammalian cells.

**Teratogenicity Data:** No human information is available. In animal studies, no teratogenic effects were observed. However, slight fetotoxicity such as reduced birth weight and functional deficits have been reported at doses, which were probably toxic to the mother.

**Synergistic Materials:** Insufficient information is available. Human studies have examined the effect of exposure to SO<sub>2</sub> along with other irritating gases such as ozone and nitrogen dioxide. No conclusive evidence of synergistic action has been seen in humans. In animal studies, it has been reported that exposure to SO<sub>2</sub> along with soluble particles such as ferrous iron, manganese and vanadium increases the toxic action of SO<sub>2</sub>.

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**12. ECOLOGICAL INFORMATION**

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**Ecotoxic Effects:** Fish Toxicity: 3000 µg/L 0.667-0.833 hrs (Avoidance) Atlantic menhaden (Brevoortia tyrannus)  
Algal Toxicity: 500 µg/L 6 days (Cellular) Green algae (Rhizoclonium hieroglyphicum)  
Phytotoxicity: >=150 µg/L NR hrs (Biochemical) Duckweed (Lemna minor)

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**13. DISPOSAL CONSIDERATIONS**

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- Product should be completely removed from containers. Material that cannot be used or chemically reprocessed should be disposed of in a manner meeting government regulations.
  - Clean-up material may be a RCRA Hazardous Waste on disposal.
  - Provincial/State or local regulations or restrictions are complex and may differ from Federal regulations.
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**14. TRANSPORT INFORMATION**

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**U.S. (Under DOT)**

**Shipping Name:** Sulfur Dioxide  
**Hazard Class and Division:** 2.3  
**Identification No.:** UN1079  
**Packing Group:** none  
**Poison:** Poison—Inhalation Hazard Zone C  
**IATA/ICAO CLASS:** 2.3

**Canada (Under TDG)**

**Shipping Name:** SULFUR DIOXIDE  
**Classification:** 2.3 (8)  
**UN Number:** UN1079  
**Packing Group:** none

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**15. REGULATORY INFORMATION**

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**U.S.A.**

OSHA Hazard Communication Evaluation:

Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

**SARA Title III HAZARD CATEGORIES AND LISTS****Product Hazard Categories**

Acute (Immediate) Health: Yes  
Chronic (Delayed) Health: Yes  
Fire: No  
Reactivity: No  
Sudden Release of Pressure: Yes

**Lists**

Extremely Hazardous Substance Yes  
(40 CFR 355, SARA Title III Section 302)  
CERCLA Hazardous Substance Yes  
(40 CFR 302.4)  
Toxic Chemical No  
(40 CFR 372.65, SARA Title III Section 313)

**Reportable Quantity (RQ) under SARA Title III/EPCRA Extremely Hazardous Substances**  
(EPCRA): RQ= 500 lbs. TPQ = 500 lbs.

**TSCA Inventory Status:** Reported/Included

**Right-To-Know:** Illinois, Massachusetts, New Jersey, Pennsylvania

**CANADA**

This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS (Material Safety Data Sheet) contains all the information required by the CPR.

**Workplace Hazardous Materials Information System (WHMIS)**

**WHMIS Classification(s):** Class A - Compressed Gas  
Class D1A - Very Toxic- Poisonous and infectious material  
Class D2A - Poisonous and infectious material - Other toxic effects

**WHMIS Health Effects Index:** Acute Lethality - very toxic - Immediate and serious effects  
**Chronic Toxicity** - Other (Pulmonary effects)

**WHMIS Ingredient Disclosure List:** Confirmed A; Meets criteria for disclosure at 1% or greater.

**European:**

**EEC CLASSIFICATION:** T, R 23; C, R 34  
**EINECS No.:** 231-195-2

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**16. OTHER INFORMATION**

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**Revision Indicators:**

Δ In the left margin indicates a revision or addition of information since the previous issue.

**REFERENCES:**

1. **RTECS-Registry of Toxic Effects of Chemical Substances**, On-line search, Canadian Centre for Occupational Health and Safety RTECS database, Doris V. Sweet, Ed., National Institute for Occupational Safety and Health, U.S. Dept. of Health and Human Services, Cincinnati, Entry Update/Dec1997.
2. CHEMLIST, 1998
3. "CHEMINFO", through "CCINFO disc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada (November 1998).
4. **HSDB-Hazardous Substances Data Bank**, through "CCINFO disc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, (November, 1998).
5. NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, June 1997
6. Sax, N.I., "Dangerous Properties of Industrial Materials", 7<sup>th</sup> Edition, 1989
7. "1998 Threshold Limit Values and Biological Exposure Indices", American Conference of Government Industrial Hygienists, 1998.
8. Merck, 11<sup>th</sup> Edition, 1989
9. Supplier's Material Safety Data Sheets.

**16. OTHER INFORMATION (continued)**

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**Legend:**

CAS #	- Chemical Abstracts Service Registry Number
CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act
CFR	- Code of Federal Regulations
DOT	- Department of Transportation
EPA	- Environmental Protection Agency
LC <sub>50</sub>	- The concentration of material in air expected to kill 50% of a group of test animals
LD <sub>50</sub>	- Lethal Dose expected to kill 50% of a group of test animals
LEL	- Lower Explosive Limit
MSHA	- Mine Safety and Health Administration
NIOSH	- National Institute for Occupational Safety and Health
PEL	- Permissible Exposure Limit
PVC	- Polyvinyl chloride
RCRA	- Resource Conservation and Recovery Act
SARA	- Superfund Amendments and Reauthorization Act of the U.S. EPA
STEL	- Short Term Exposure Limit
TDG	- Transportation of Dangerous Goods Act/Regulations
TLV	- Threshold Limit Value
TSCA	- Toxic Substances Control Act
TWA	- Time-Weighted Average
UEL	- Upper Explosive Limit

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