



1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sulfur Dioxide

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	4 = Extreme/Severe
FIRE	0	0	3 = High/Serious
REACTIVITY	0	0	2 = Moderate
SPECIAL			1 = Slight
PERSONAL PROTECTION			0 = Minimum
			W = Water Reactive



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3. HAZARD INFORMATION (continued)

Exposure Limits:

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

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.

5. FIRE AND EXPLOSION DATA

Flash Point: Not applicable, product is non-flammable

Flammable Limits (Lower): Not applicable

Flammable Limits in air (Upper): Not applicable

Autoignition Temperature: Not applicable

Combustion and Thermal Decomposition Products: Oxides of Sulfur

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.

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. Prevent material from entering waterways, sewers or confined spaces.

Small Spill or Leak: See instructions below

Large Spill or Leak: 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.

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.

7. HANDLING AND STORAGE

Handling: 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. Use corrosion-resistant transfer equipment. Regularly check storage tanks and transfer equipment for evidence of corrosion or leakage. If sulfur dioxide is accidentally released, immediately put on a suitable respirator and leave the area until the severity of the release is determined. In case of leaks or spills, escape-type respiratory protective equipment should be available in the work area.

Storage: Storage temperature should be at or around normal room temperature. Protect from temperature extremes. Never expose cylinders to temperatures higher than 52°C (125°F) or below -29°C (-20°F) unless they are designed for this. Maintain temperature such that the resultant vapor pressure is lower than the relief setting.

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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: Heavyweight coveralls, safety boots and insulated impervious (i.e., neoprene, PVC) gloves.

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.

Pictograms:

EXPOSURE GUIDELINES:
HAZARDOUS INGREDIENT(S):
Sulfur Dioxide:

ACGIH TLV(2003)	2 ppm	5.2 mg/m ³ (TWA) 8 hours
ACGIH TLV (2003)	5 ppm	13 mg/m ³ (STEL) 15 minutes
OSHA PEL (1993)	5 ppm	13 mg/m ³ (TWA) 8 hours
NIOSH REL (2001)	5 ppm	13 mg/m ³ (STEL) 15 minutes
NIOSH REL (2001)	2 ppm	5 mg/m ³ (TWA) 10 hours



9. PHYSICAL AND CHEMICAL PROPERTIES

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/m²/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).

10. STABILITY AND REACTIVITY

Stability: The product is stable under normal conditions

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

11. TOXICOLOGICAL INFORMATION

Toxicological Data: LC₅₀ (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 SO₂ may be related to adverse reproductive effects. However, it is not clear that SO₂ caused the effects observed in any of these studies. There are no relevant results from animal studies.

Mutagenicity Data: SO₂ 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 SO₂ 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 SO₂ along with soluble particles such as ferrous iron, manganese and vanadium increases the toxic action of SO₂.

12. ECOLOGICAL INFORMATION

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)

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations

14. TRANSPORT INFORMATION

U.S. (Under DOT)

Shipping Name: Sulfur Dioxide
Hazard Class or Division: 2.3
Identification No.: UN1079
Packing Group: none

ER Guide: 125

IATA/ICAO CLASS: 2.3

Canada (Under TDG)

Shipping Name: Sulfur dioxide
Classification(s): Class 2.3 (8)
Product Identification No. (PIN): UN1079
Packing Group: none

15. REGULATORY INFORMATION

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 (40 CFR 355, SARA Title III Section 302)	Yes
CERCLA Hazardous Substance (40 CFR 302.4)	Yes
Toxic Chemical (40 CFR 372.65, SARA Title III Section 313)	Yes

California Prop 65: No products were found



15. REGULATORY INFORMATION (continued)

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

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
Class E – Corrosive Gas

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.

CEPA DSL: Sulfur Dioxide

EUROPEAN:

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

16. OTHER INFORMATION

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 (2007).
4. **HSDB-Hazardous Substances Data Bank**, through "CCINFO disc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, (2007).
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", 7th Edition, 1989
7. "2006 Threshold Limit Values and Biological Exposure Indices", American Conference of Government Industrial Hygienists, 2006.
8. Merck, 12th Edition, 1999
9. Supplier's Material Safety Data Sheets.



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 ₅₀	- The concentration of material in air expected to kill 50% of a group of test animals
LD ₅₀	- 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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