

Material Safety Data Sheet

Sulfur Dioxide

1. Product and company identification

Product name	: Sulfur Dioxide
Material uses	: Used as a bleaching agent, refrigerant, solvent and in processing food products.
Headquarters	: Marsulex Inc. 111 Gordon Baker Road Suite 300 North York, ON M2H 3R1 (416) 496-9655 www.marsulex.com
MSDS authored by	: KMK Regulatory Services inc.
<u>In case of emergency</u>	: Canada: CANUTEC +1-613-996-6666 US: CHEMTREC +1-800-424-9300
Product type	: Gas.

2. Hazards identification

Emergency overview

Color	: Colorless.
Physical state	: Gas or liquified gas.
Odor	: Pungent. [Strong]
Signal word	: DANGER!
Hazard statements	: CAUSES RESPIRATORY TRACT AND DIGESTIVE TRACT BURNS. CONTENTS UNDER PRESSURE. NON-FLAMMABLE GAS. HARMFUL IF INHALED. CAN CAUSE TARGET ORGAN DAMAGE.
Precautions	: Extremely hazardous liquid and vapor under pressure. Keep away from heat, sparks and flame. Do not get in eyes or on skin or clothing. Do not puncture or incinerate container. Do not breathe gas/fumes/ vapor/spray. Use only with adequate ventilation. Keep container closed. Wash thoroughly after handling.
OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Routes of entry	: Dermal contact. Eye contact. Inhalation. Ingestion.
<u>Potential acute health effects</u>	
Inhalation	: Vapors are extremely irritating to throat, mucous membranes and upper respiratory tract. Short exposures to concentrations as low as 1 ppm may produce a reversible decrease in lung function. Concentrations as low as 5 ppm have produced constriction of the bronchiole tubes. About 20 ppm is objectionably irritating. In addition, about 10 to 20% of the adult population is estimated to be hypersensitive to the adverse respiratory effects of sulfur dioxide; however, workers regularly exposed to compound show an adaptation effect. Severe overexposure may result in pulmonary edema, permanent lung injury or death. The effects of pulmonary edema that include coughing and shortness of breath may be delayed for hours or days after exposure.
Ingestion	: Since material is a gas at room temperature, ingestion is unlikely to occur.
Skin	: Liquid sulfur dioxide can cause frostbite and skin burns. Sulfur Dioxide will react with moisture on the skin and can cause skin irritation or corrosive injury if the concentration is high or exposure prolonged.
Eyes	: 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.
<u>Potential chronic health effects</u>	
Chronic effects	: May cause target organ damage, based on animal data.
Carcinogenicity	: No known significant effects or critical hazards.

2. Hazards identification

- Mutagenicity** : No known significant effects or critical hazards.
- Teratogenicity** : No known significant effects or critical hazards.
- Developmental effects** : No known significant effects or critical hazards.
- Fertility effects** : No known significant effects or critical hazards.
- Target organs** : May cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.
- Over-exposure signs/symptoms**
- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
coughing
Several human studies have shown that repeated exposure to low levels of SO₂ (below 5 ppm) has caused permanent pulmonary impairment.
- Ingestion** : No specific data.
- Skin** : Several human studies have shown that repeated exposure to low levels of SO₂ (below 5 ppm) has caused permanent pulmonary impairment.
- Eyes** : No specific data.
- Medical conditions aggravated by over-exposure** : Dental caries, loss of fillings, gum disorders and the rapid and painless destruction of teeth may result from over-exposure. 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. Asthmatic individuals are especially sensitive to sulfur dioxide. Any disorder inhibiting nasal respiration or any cardiovascular disease may preclude exposure to sulfur dioxide. Skin irritation may be aggravated in individuals with existing skin lesions.

See toxicological information (section 11)

3. Composition/information on ingredients

United States

Name	CAS number	%
Sulfur dioxide	7446-09-5	99 - 100

Canada

Name	CAS number	%
Sulfur dioxide	7446-09-5	99 - 100

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4. First aid measures

- 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.
- Skin contact** : For gas, flush skin with running water for a minimum of 5 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. For liquid, briefly flush with lukewarm, gently flowing water until the chemical is removed. Do not attempt to rewarm the affected area on site. Do not rub area or apply dry heat. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. 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.

4. First aid measures

- Ingestion** : Since the product is a gas, it will probably be inhaled rather than ingested. Consider first the preventive measures in case of inhalation.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.
- Notes to physician** : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Extinguishing media**
- Suitable** : Use appropriate media to extinguish source of fire.
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.
- Not suitable** : None known.
- Special exposure hazards** : Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
- Hazardous thermal decomposition products** : Decomposition products may include the following materials:
sulfur oxides
- Special protective equipment for fire-fighters** : Not applicable.
- Special remarks on fire hazards** : Not available.
- Special remarks on 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

- Personal precautions** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
- Environmental precautions** : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
- Methods for cleaning up**
- Small spill** : See instructions below

6. Accidental release measures

- Large spill** : 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:** Lime, limestone, soda ash, sodium bicarbonate, dilute sodium hydroxide or dilute aqua ammonia.

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.

8. Exposure controls/personal protection

United States

Ingredient	Exposure limits
Sulfur dioxide	<p>ACGIH TLV (United States, 1/2009). STEL: 0.25 ppm 15 minute(s).</p> <p>NIOSH REL (United States, 6/2008). STEL: 13 mg/m³ 15 minute(s). STEL: 5 ppm 15 minute(s). TWA: 5 mg/m³ 10 hour(s). TWA: 2 ppm 10 hour(s).</p> <p>OSHA PEL (United States, 11/2006). TWA: 13 mg/m³ 8 hour(s). TWA: 5 ppm 8 hour(s).</p>

Canada

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			Notations
Ingredient	List name	ppm	mg/m ³	Other	ppm	mg/m ³	Other	ppm	mg/m ³	Other	
Sulfur dioxide	US ACGIH 1/2009	-	-	-	0.25	-	-	-	-	-	
	AB 6/2008	2	5.2	-	5	13	-	-	-	-	
	BC 6/2008	2	-	-	5	-	-	-	-	-	
	ON 6/2008	2	5.2	-	5	10.4	-	-	-	-	
	QC 6/2008	2	5.2	-	5	13	-	-	-	-	

Consult local authorities for acceptable exposure limits.

- Recommended monitoring procedures** : Personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

- Engineering measures** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits.

8. Exposure controls/personal protection

- Hygiene measures** : Ensure that eyewash stations and safety showers are close to the workstation location. Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
- Personal protection**
- Respiratory** : 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 or supplied air respirator (SAR) operated in a continuous flow mode for concentrations up to 50 ppm. A full-facepiece chemical cartridge respirator with cartridges to protect against sulfur dioxide; or gas mask with canister to protect against sulfur dioxide; or powered air-purifying respirator with a tight-fitting facepiece and cartridge(s) to protect against sulfur dioxide; or full-facepiece self-contained breathing apparatus (SCBA); or full-facepiece SAR; or SAR with a tight-fitting facepiece operated in a continuous-flow mode if concentrations are up to and higher than 100 ppm.
- Hands** : Use gloves appropriate for work or task being performed. Recommended: Neoprene, PVC, vinyl or rubber.
- Eyes** : Safety eyewear should be used when there is a likelihood of exposure. Recommended: Splash goggles.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: Lab coat or coveralls.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. Physical and chemical properties

- Physical state** : Gas or liquified gas.
- Color** : Colorless.
- Odor** : Pungent. [Strong]
- Molecular weight** : 64.06 g/mole
- Molecular formula** : SO₂
- pH** : Not applicable. In water, sulfur dioxide is rapidly converted to sulfurous acid (pH less than 3).
- Boiling/condensation point** : -9.99°C (14°F)
- Melting/freezing point** : -75.55°C (-104°F)
- Critical temperature** : 156.9°C (314.4°F)
- Specific gravity** : 1.45 g/cm³
- Vapor density** : 2.2 [Air = 1]
- Volatility** : 100% (v/v)
- Evaporation rate** : 243.2 (butyl acetate = 1)
- Solubility** : 11.9% by wt. in water at 15°C (60°F) and 760 mmHg. Also soluble in alcohol, chloroform, ether, acetic acid.

10. Stability and reactivity

- Chemical stability** : The product is stable.
- Conditions to avoid** : No specific data.
- Materials to avoid** : Moist gas corrodes most metals. Reacts with water. Reacts violently with strong alkalis, (e.g. sodium hydroxide, fluorine), bromine pentafluoride, chlorine trifluoride, chlorates, powdered metals, (e.g. chromium, manganese, aluminum), metal oxides, metal acetylides, sodium hydride, cesium azide, silver azide and diethyl zinc.
- Hazardous decomposition products** : Will form sulfur trioxide and sulfurous acid.

10. Stability and reactivity

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

11. Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Sulfur dioxide	LC50 Inhalation Gas.	Rat	2520 ppm	1 hours

Special remarks on toxicity to animals : Not available.

Chronic toxicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Sulfur dioxide	A4	3	-	-	-	-

IDLH : 100 ppm

12. Ecological information

Environmental effects : Not established

Toxicity of the products of biodegradation : The products of degradation are toxic.

Products of degradation : Decomposition products may include the following materials: sulfur oxides (SO₂, SO₃ etc.)



13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. This material and its container must be disposed of in a safe way. Do not puncture or incinerate container. Empty pressure vessels should be returned to the supplier. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.







Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14. Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN1079	SULFUR DIOXIDE	2.3 (8)	-	 	<p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: 25 to 25 kg</p> <p>Special provisions 3, B14, T50, TP19</p>

14 . Transport information

TDG Classification	UN1079	SULFUR DIOXIDE	2.3 (8)	-	 	-
IMDG Class	UN1079	SULFUR DIOXIDE	2.3 (8)	-	 	-
IATA-DGR Class	UN1079	SULFUR DIOXIDE	2.3 (8)	-	 	Passenger and Cargo Aircraft Quantity limitation: Forbidden Cargo Aircraft Only Quantity limitation: 25 kg

PG* : Packing group

AERG : 125

Exemption to the above classification may apply.

15 . Regulatory information

United States

HCS Classification : Compressed gas
 Highly toxic material
 Corrosive material
 Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: Sulfur dioxide
SARA 302/304 emergency planning and notification: Sulfur dioxide
SARA 302/304/311/312 hazardous chemicals: Sulfur dioxide
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Sulfur dioxide: Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard
Clean Water Act (CWA) 307: No products were found.
Clean Water Act (CWA) 311: No products were found.
Clean Air Act (CAA) 112 accidental release prevention: Sulfur dioxide
Clean Air Act (CAA) 112 regulated flammable substances: No products were found.
Clean Air Act (CAA) 112 regulated toxic substances: Sulfur dioxide

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

15 . Regulatory information

**DEA List II Chemicals
(Essential Chemicals)** : Not listed

State regulations :

- Connecticut Carcinogen Reporting:** This material is not listed.
- Connecticut Hazardous Material Survey:** This material is not listed.
- Florida substances:** This material is not listed.
- Illinois Chemical Safety Act:** This material is not listed.
- Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
- Louisiana Reporting:** This material is not listed.
- Louisiana Spill:** This material is not listed.
- Massachusetts Spill:** This material is not listed.
- Massachusetts Substances:** This material is listed.
- Michigan Critical Material:** This material is not listed.
- Minnesota Hazardous Substances:** This material is not listed.
- New Jersey Hazardous Substances:** This material is listed.
- New Jersey Spill:** This material is not listed.
- New Jersey Toxic Catastrophe Prevention Act:** This material is not listed.
- New York Acutely Hazardous Substances:** This material is listed.
- New York Toxic Chemical Release Reporting:** This material is not listed.
- Pennsylvania RTK Hazardous Substances:** This material is listed.
- Rhode Island Hazardous Substances:** This material is not listed.

California Prop. 65

No products were found.

Canada

WHMIS (Canada) :

- Class A: Compressed gas.
- Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
- Class E: Corrosive material

Canadian lists :

- CEPA Toxic substances:** This material is listed.
- Canadian ARET:** This material is not listed.
- Canadian NPRI:** This material is listed.
- Alberta Designated Substances:** This material is not listed.
- Ontario Designated Substances:** This material is not listed.
- Quebec Designated Substances:** This material is not listed.

Canada inventory : This material is listed or exempted.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International regulations

International lists :

- Australia inventory (AICS):** This material is listed or exempted.
- China inventory (IECSC):** This material is listed or exempted.
- Japan inventory:** This material is listed or exempted.
- Korea inventory:** This material is listed or exempted.
- New Zealand Inventory of Chemicals (NZIoC):** This material is listed or exempted.
- Philippines inventory (PICCS):** This material is listed or exempted.

**Chemical Weapons
Convention List Schedule I
Chemicals** : Not listed

**Chemical Weapons
Convention List Schedule
II Chemicals** : Not listed

**Chemical Weapons
Convention List Schedule
III Chemicals** : Not listed

16 . Other information

United States

Label requirements : CAUSES RESPIRATORY TRACT AND DIGESTIVE TRACT BURNS. CONTENTS UNDER PRESSURE. NON-FLAMMABLE GAS. HARMFUL IF INHALED. CAN CAUSE TARGET ORGAN DAMAGE.

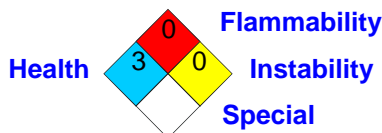
Hazardous Material Information System (U.S.A.) :

Health	*	3
Flammability		0
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



Canada

WHMIS (Canada) :



References

: - 29CFR Part 1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG. ANSI Z400.1, MSDS Standard, 2004. - Canada Gazette Part II, Vol. 122, No. 2. Registration SOR/88-64, 31 December 1987. Hazardous Products Act "Ingredient Disclosure List" - Canadian Transport of Dangerous Goods, Regulations and Schedules, Clear Language version 2005. - Manufacturer's Material Safety Data Sheet.

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Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.