

SULFUR DIOXIDE MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Sulfur Dioxide

Manufacturer:

Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:

Teck American Incorporated
Industrial Chemicals
501 North Riverpoint Blvd., Suite 300,
Spokane, WA. 99202

MSDS Preparer:

Teck Metals Ltd.
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Vancouver, British Columbia
V6C 0B3

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Product Use: Used in the manufacture of chlorine dioxide (a pulp and paper bleaching chemical), as a dechlorination agent in the pulp and paper industry and waste water treatment plants, in the food processing industries as a preservative, as a chemical additive in the gold industry cyanide destruction process, in the manufacture of sodium bisulfite solution and in the manufacturing of sodium hydrosulfite.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)	LD ₅₀ / LC ₅₀ Species and Route
Sulfur Dioxide	99.9%	7446-09-5	OSHA PEL 5 ppm (13 mg/m ³) ACGIH STEL 0.25 ppm (0.65 mg/m ³) NIOSH REL 2 ppm (5 mg/m ³)	LC ₅₀ , rat, inhal 2520 ppm/1Hr LC ₅₀ , mouse, inhal. 3000 ppm/30Min LC ₅₀ rat (calculated) 1260 ppm/4Hr

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA - Occupational Safety and Health Administration; ACGIH - American Conference of Governmental Industrial Hygienists; NIOSH - National Institute for Occupational Safety and Health.
OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit
STEL – Short Term Exposure Limit

Trade Names and Synonyms: Sulfurous acid anhydride, sulfurous oxide, sulphur dioxide, SO₂

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: A colorless gas or liquefied compressed gas with a pungent, irritating odor and taste. Sulfur dioxide does not burn but cylinders or tanks may rupture and explode if heated, releasing clouds of irritating and toxic SO₂ gas. Contact with liquid SO₂ can cause freezing of tissue and frostbite. Wear full protective clothing and a positive pressure full face-piece SCBA in emergency situations involving SO₂.

Potential Health Effects: Irritating to the eyes and upper respiratory tract, becoming a severe irritant at high concentrations. Most inhaled SO₂ only penetrates as far as the nose and throat because it dissolves so rapidly in the moist tissues of the upper airways. In severe cases at very high concentrations serious respiratory effects have been reported. Direct skin or eye contact with liquid SO₂ may cause frostbite. Sulfur dioxide is not listed as a carcinogen by OSHA, NTP, IARC, ACGIH or the EU. (See Toxicological Information, Section 11)

Potential Environmental Effects: Sulfur dioxide is a common air contaminant in most industrialized areas; it is also the chemical precursor to acid rain. At elevated concentrations, plants are sensitive to atmospheric sulfur dioxide. Release of this product to the environment should be avoided. (See Ecological Information, Section 12)

SECTION 4. FIRST AID MEASURES

Eye Contact: Avoid direct contact. Wear chemical protective gloves if necessary. Remove source of contamination or move victim to fresh air. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 5 minutes for the gas (20 minutes for the liquid) or until the chemical is removed, while holding the eyelid(s) open. Take care not to rinse contaminated water into the unaffected eye or onto the face. Quickly transport victim to an emergency care facility.

Skin Contact: (Gas) If irritation occurs, flush contaminated area with lukewarm, gently flowing water for at least 5 minutes. If irritation persists, obtain medical attention immediately. (Liquid SO₂) Avoid direct contact. Wear chemical protective clothing, if necessary. Quickly remove victim from source of contamination and briefly flush with lukewarm, gently flowing water until the chemical is removed. DO NOT attempt to re-warm the affected area on site. DO NOT rub area or apply dry heat. Gently remove clothing or jewelry that may restrict circulation. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. Loosely cover the affected area with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Quickly transport victim to an emergency care facility.

Inhalation: Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment, use the buddy system). Remove source of contamination or move victim from exposure area to fresh air immediately. If breathing is difficult, trained personnel should administer medical oxygen. DO NOT allow victim to move around unnecessarily. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Quickly transport victim to an emergency care facility.

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

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Sulfur dioxide is not flammable. However, heat from a surrounding fire can rupture vessels causing a dangerous explosion and release of toxic sulfur dioxide gas. Cool any containers of sulfur dioxide that are exposed to heat or flames by the application of water streams until well after the fire has been extinguished since pressure will increase rapidly with temperature increase. For large fires that threaten tanks or cylinders of SO₂ consider evacuating downwind areas. Use caution in applying water to an SO₂ leak, as the run-off will be acidic and corrosive to other materials as well as harmful to the environment. Run-off may require collection and neutralization.

Extinguishing Media: Use any fire fighting agent appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Toxic fumes of sulfur dioxide may be released during a fire. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Not Applicable.

Autoignition Temperature: Not Applicable.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Isolate hazard area and deny entry to unprotected personnel. Properly trained personnel equipped with protective clothing and respiratory protection should locate and stop release. Can be neutralized with aqueous alkaline solutions of lime, caustic or soda ash. Dispose of waste material from neutralization process in accordance with applicable regulations. Thoroughly ventilate area before permitting re-entry.

Personal Precautions: Protective clothing, gloves, and respirator equipment are recommended for persons responding to an accidental release (see also Section 8). Close-fitting safety goggles and face shield may be necessary to prevent contact with liquid SO₂. A positive pressure full-face self-contained breathing apparatus (SCBA) is required for emergency or planned entry into unknown high concentrations of SO₂ that may exceed the IDLH level (100 ppm).

Environmental Precautions: This product has the potential to pose risks to aquatic and terrestrial plants, due to their sensitivity to its constituent compound. Discharge to the aquatic environment should be prevented. Liquid spills can produce elevated concentrations of SO₂ gas, whose clouds would be heavier than air, and which may either flow downhill, or collect in low spots; in both cases, the clouds would not be easily dispersed, elevating SO₂ concentrations in the receiving environment.

SECTION 7. HANDLING AND STORAGE

Store in a registered steel pressure vessel, constructed to comply with ASME Section 8 Code, at appropriate temperatures. Keep containers tightly closed and store outdoors or indoors in a dry, cool, well-ventilated fireproof area. Protect against physical damage. SO₂ gas is heavier than air and leaked gas can accumulate in low areas. Do not store below ground. Flooring and sumps should be acid-proof and drain to a collection system. Avoid exposure to moisture, high temperatures and incompatible materials (see Section 10 - Stability and Reactivity).

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: When handling liquid SO₂, gloves and coveralls or other protective clothing are recommended to prevent the skin from becoming frozen by contact with the liquid or from contact with very cold vessels and equipment handling the liquid (especially loading and off-loading of trucks and railcars). Face shield and close-fitting safety goggles must be worn when handling this material in liquid form. An eyewash and quick drench shower should be provided within the immediate work area for emergency use where there is any possibility of exposure to liquids that are extremely cold or rapidly evaporating.

Ventilation: Use adequate local or general ventilation to maintain the concentration of sulfur dioxide gas in the working environment well below recommended occupational exposure limits.

Respiratory Protection: Where sulfur dioxide gas is generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a chemical cartridge respirator with cartridge(s) to protect against sulfur dioxide up to 20 ppm, a full face-piece chemical cartridge respirator or half mask PAPR or SAR up to 100 ppm). For emergency or planned entry into an unknown concentration or IDLH condition, workers must be fully-trained and wear full protective clothing including a NIOSH-approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

NOTE: - IDLH = Immediately Dangerous to Life or Health, PAPR = Powered Air Purifying Respirator, SAR = Supplied Air Respirator

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless Gas or Liquid	Odor: Pungent and Irritating	Physical State: Liquid (liquefied compressed gas)	pH: Not Applicable
Vapor Pressure: 47.8 PSIG at 68°F, 20°C	Vapor Density: 2.26 @ 0°C	Boiling Point/Range: -10 °C, (14°F)	Freezing Point/Range: -76°C, (-104°F)
Specific Gravity: 1.44 at 32°F, 0°C	Evaporation Rate: 40.18 g/m ² /s at 70°F, 21°C	Coefficient of Water/Oil Distribution: Unknown	Odor Threshold: 1-3 ppm
Solubility in Water: 11.9 % by weight at 60°F, 16°C			

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Stable under conditions of normal use. SO₂ is extremely stable to heat even up to 2000°C. Forms a moderately acidic solution (pH<3) on contact with moisture in the atmosphere or on the skin. Moist SO₂ gas is corrosive to most common metals.

Incompatibilities: Strong alkalis, ammonia, oxidizing agents, chlorates, powdered chromium, manganese or aluminum, halogens (fluorine, chlorine) and interhalogens (chlorine trifluoride, etc), metal oxides, hydrides, azides and acetylides, sodium carbide and acrolein.

Hazardous Decomposition Products: None.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Sulfur dioxide is a moderate to strong irritant gas and the major effects are on the upper respiratory tract. Asthmatics may be particularly sensitive to the bronchospastic properties of sulfur dioxide. The major route of exposure to the gas is by inhalation. Skin and eye contact with liquid SO₂ are also serious risks. Since sulfur dioxide is a gas at temperatures greater than -10 degrees Celsius, ingestion is unlikely to occur.

Acute:

Skin/Eye: Skin contact with liquid sulfur dioxide can cause frostbite and severe burns. Eye contact may result in severe burns and corneal damage that can result in blindness. High concentrations of SO₂ gas (>10 ppm) are very irritating to the eyes as well, causing smarting, stinging and tearing. The gas will react with moisture on the skin and cause irritation.

Inhalation: Inhalation of sulfur dioxide gas may cause wheezing, tightness of the chest, cough, difficult breathing, nasal irritation and discharge and alteration in the sense of taste and smell. Pulmonary edema and permanent lung injury have been reported as a result of exposure to very high levels of SO₂ gas in accident situations.

Ingestion: Though unlikely to occur, ingestion of liquid sulfur dioxide would cause severe burning of the mouth, throat and stomach.

Chronic: A number of studies of occupationally exposed workers have been done, with some studies showing a decrease in lung function of workers and other studies showing no measurable effect. Sulfur dioxide is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or the American Conference of Governmental Industrial Hygienists (ACGIH).

SECTION 12. ECOLOGICAL INFORMATION

Sulfur dioxide, when it comes into contact with water, has the potential to form sulfurous acid, which can pose ecological risks to aquatic organisms. Moreover, releases of the compound as a gas also has the potential to adversely affect green vegetation, in addition to birds and mammals.

SECTION 13. DISPOSAL CONSIDERATIONS

Do not wash down drain or allow to reach natural watercourses. Dispose of neutralized waste consistent with regulatory requirements. Good ventilation is required during neutralization because of the presence of sulfur dioxide gas.

SECTION 14. TRANSPORT INFORMATION

Proper Shipping Name Transport Canada and U.S. DOT.....	Sulfur Dioxide (U.S.) or Sulphur Dioxide (Canada)
Transport Canada Classification	Class 2.3 (8)
U.S. DOT Hazard Classification	Class 2.3, 8
Transport Canada Product Identification Number	UN 1079
U.S. DOT Product Identification Number	UN 1079
Additional U.S. DOT Hazard Information.....	Toxic-Inhalation Hazard, Zone C
Marine Pollutant	No
IMO Classification	Class 2.3, 8

SECTION 15. REGULATORY INFORMATION

U.S.

Ingredient Listed on TSCA Inventory Yes

Hazardous Under Hazard Communication Standard Yes

CERCLA Section 103 Hazardous Substances..... No

EPCRA Section 302 Extremely Hazardous Substance..... Yes..... Reportable Quantity: 500 lbs.
Threshold Planning Quantity: 500 lbs.

EPCRA Section 311/312 Hazard Categories: Immediate (Acute) Health Hazard - Corrosive
Sudden Release of Pressure - Compressed Gas

EPCRA Section 313 Toxic Release Inventory: Sulfur dioxide is not a toxic chemical subject to Toxic Release Inventory reporting requirements.

CANADIAN:

Listed on Domestic Substances List Yes

WHMIS Classification:..... A (Compressed Gas)
D1A (Very Toxic Material - Poisonous)
E (Corrosive)

SECTION 16. OTHER INFORMATION

The information in this Material Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2009, Guide to Occupational Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2009, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urban, Ed.) 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) Hamilton, Ontario, CHEMINFO Record No. 714 – Sulfur Dioxide (Last Revision 2009-03).
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Dioxyde de Soufre, 2002-08.
- European Economic Community, Commission Directives 91/155/EEC, 93/21/EEC, and 67/548/EEC.
- Industry Canada, Controlled Products Regulations SOR/88-66, as amended.
- International Chemical Safety Cards (WHO/IPCS/ILO), ICSC:0074 – Sulphur Dioxide (Revised Oct. 2006).
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank (on-line version).
- Patty's Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohnsen & C.H. Powell, Ed.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health. NIOSH Pocket Guide to Chemical Hazards. CD-ROM Edition DHHS (NIOSH) September 2005.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

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