NorLAB
A DIVISION OF NORCO, INC.

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Sulfur Dioxide 0.0001% to 1% in Nitrogen

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Sulfur Dioxide 0.0001% to 1% in Nitrogen
CAS Number: N/A
Chemical Family: Gas Mixture
Chemical Formula: SO_2 in Nitrogen
Synonyms: N/A
MSDS Identification Code/Number 2200
Prepared By: Quality Dept.

Revision Date: 02/26/01
Last Review Date: 02/20/07

Composition, Information on Ingredients

Exposure Limits[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Sulfur Dioxide Formula: SO_2 in N_2 CAS: 7446-09-5 RTECS#: WS4550000	≤ 1%	5 ppm TWA	2 ppm TWA 5ppm STEL	LC50: 2520 ppm Inhalation/rat (1 hr.)
Nitrogen Formula: N_2 CAS: 7727-37-9 RTECS#: QW9700000	99.0 to 99.9999%	None Established	Simple Asphyxiant	Not Available

[1] Refer to individual state or provincial regulations, as applicable, for limits that may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993).
[3] As stated in the ACGIH 2006 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.
IDLH: 100 ppm (SO_2)

Hazards Identification

Emergency Overview:

Colorless non-flammable gas with characteristic odor. May cause skin, eye and upper respiratory irritation. High concentrations of sulfur dioxide may cause pulmonary edema and chemical pneumonitis. Nitrogen acts as a simple asphyxiant by displacing oxygen necessary to support life. Sulfur dioxide reacts with water to produce sulfuric acid. Contents under pressure. Use and store below 125^{O} F (52^{O} C).

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

Hazards Identification continued

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects Sulfur dioxide may act as a cocarcinogen with benzo[a]pyrene in the rodent respiratory tract.		

Carcinogenicity: NTP: No IARC: No OSHA: No

Eye Effects:
May cause irritation with associated redness, swelling, and tears. Contact with rapidly expanding gas near the point of release may cause frostbite.

Skin Effects:
May irritate the skin upon contact. Contact with rapidly expanding gas near the point of release may cause frostbite with redness, skin color change to gray or white, and blistering.

Ingestion Effects:
Ingestion is unlikely. Product is a gas at room temperature.

Inhalation Effects:
Sulfur dioxide is very irritating and generally causes sever nose, throat and respiratory irritation before toxic concentrations are present. Exposure to low concentrations of sulfur dioxide may cause sneezing, coughing, bronchospasm, and systemic acidosis. Relative high concentrations of product would have to be inhaled for pulmonary edema or respiratory arrest to occur, however, individual susceptibility to the effects of sulfur dioxide varies.

Prolonged or repeated low level exposures may impair lung function and cause corrosion of the teeth.

Reproductive toxicity and developmental changes in newborn have been observed in experimental animals exposed to sulfur dioxide. Sulfur dioxide is mutagenic in experimental cell assay systems.

Nitrogen acts as a simple asphyxiant. Accumulation of high concentrations can displace oxygen content in the air necessary to support life.

Medical Conditions Aggravated by Exposure:
May aggravate pre-existing eye, skin and respiratory disorders. Persons with pre-existing respiratory, nasal and cardiovascular disease may be more susceptible to effects of sulfur dioxide exposure.

NFPA Hazard Codes		**HMIS Hazard Codes**		**Ratings System**
Health:	1	Health:	1	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight hazard
Reactivity:	0	Physical Hazard:	3	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Hazard ratings were assigned according to Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2004, *CGA Recommended Hazard Ratings for Compressed Gases, 2nd Edition.*

First Aid Measures

Eye:
PERSONS WITH POTENTIAL EXPOSURE TO SULFUR DIOXIDE SHOULD NOT WEAR CONTACT LENSES. Flush eyes with large amounts of water for at least 15 minutes, holding eyelids open to ensure adequate rinsing. If irritation persists or frostbite is suspected, seek immediate medical attention.

First Aid Measures Continued

Skin:
Remove contaminated clothing and flush affected area with large quantities of water. For frostbite, immerse skin in lukewarm water. DO NOT USE HOT WATER. If frostbite occurs or irritation persists, seek medical attention.

Ingestion:
Not anticipated; product is a gas at room temperature.

Inhalation:
PROMPT REMOVAL FROM THE CONTAMINATED AREA AND IMMEDIATE MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Keep victim warm and calm. Further treatment should be symptomatic and supportive. Seek immediate medical attention.

Fire Fighting Measures

Conditions of Flammability: Not flammable		
Flash point: Gas	Method: Not Applicable	Autoignition Temperature: None
LEL (%): Not Applicable	UEL (%): Not Applicable	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

Fire and Explosion Hazards:
Nonflammable. Cylinders may vent rapidly or rupture violently from pressure when involved in a fire situation.

Extinguishing Media:
Use media suitable for surrounding combustible or flammable materials. Sulfur dioxide forms sulfuric acid solutions with water.

Fire Fighting Instructions:
Stop the flow of gas if it can be done without risk. Use water spray to cool surrounding containers. Continue to cool surrounding containers until well after flames are extinguished. Firefighters should wear a full-face piece, NIOSH/MSHA-approved self-contained breathing apparatus (SCBA) operated in positive pressure mode and full turnout gear.

Accidental Release Measures

Isolate hazard area, evacuate personnel and deny entry to unauthorized/unprotected individuals. Extinguish all ignition sources and ventilate closed spaces and low areas. Personnel entering area should wear appropriate protective equipment, including respiratory protection suitable for unknown concentrations. Personnel should not re-enter an area until sulfur dioxide has sufficiently dispersed and adequate oxygen re-established. If a leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest Norco/NorLab location.

Handling and Storage

Electrical classification:
Non-hazardous

Use only in well-ventilated areas. Valve protection caps must remain in place on refillable cylinders unless cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the

Handling and Storage Continued

discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavy traffic areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125^{O} F. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional recommendations, consult Compressed Gas Association Pamphlets P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

Exposure Controls, Personal Protection

Engineering Controls:
Use a laboratory hood with forced ventilation for handling small quantities. Use local exhaust to prevent accumulation above the exposure limit.

Eye/Face Protection:
Chemical safety goggles with full face shield.

Skin Protection:
Protective gloves as appropriate for the job (Saranex™, Barricade™ and responder™ are appropriate for greater than 8 hour exposures to pure sulfur dioxide).

Respiratory Protection:
A NIOSH/MSHA-approved full-facepiece SCBA operated in positive mode and/or any supplied air respirator with a full-facepiece and operated in a positive pressure mode in combination with an auxiliary self contained breathing apparatus operated in positive pressure mode should be used for high or unknown concentrations. Respirators should be stored in an area not likely to be contaminated.

Other/General Protection:
Safety shoes, safety showers and an emergency eyewash station should be available.

Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not available	
Vapor density (Air = 1)	: 0.97	
Evaporation point	: Not available	
Boiling point	: -320.4	^{O}F
	: -195.8	^{O}C
Freezing point	: -345.9	^{O}F
	: -209.9	^{O}C
pH	: Not available	
Specific gravity	: Not available	
Oil/water partition coefficient	: Not available	
Solubility (H_2O)	: ≤ 1% (mixture)	
Odor threshold	: No data	
Odor and appearance	: Colorless gas/vapor with a highly irritating, pungent odor.	

Stability and Reactivity

Stability:
Stable under normal conditions.

Incompatible Materials:
Mixture contains only 0-1% sulfur dioxide. The following data is for pure sulfur dioxide. Reacts violently with peroxides, chromates, permanganates and oxygen difluoride. It also reacts with chlorates to form chlorine, which may become explosive at elevated temperatures. Forms sulfuric acid solutions with water.

Hazardous Decomposition Products:
Sulfur dioxide reacts with water to form sulfuric acid. Thermal decomposition produces toxic CO_x and SO_x.

Hazardous Polymerization:
Will not occur.

Toxicological Information

Inhalation:
Dryness of the nose and throat and bronchoconstriction occurs following inhalation of 5 ppm or more sulfur dioxide. From 6 to 8 ppm a decrease in tidal respiratory volume occurs. Exposure to 20 ppm sulfur dioxide caused brocnchospasm and 50 ppm causes extreme discomfort.

Skin and Eye:
Sulfur dioxide is an irritant at 8 to 12 ppm with conjunctival irritation and lacrimation. Irritation becomes severe at 50 ppm.

Sub chronic:
Repeated exposure to sulfur dioxide has caused thickening of the mucous layer in the trachea and increases in goblet cells and mucous glands in test animals.

Chronic:
No evidence of decreased pulmonary function was seen in guinea pigs exposed to 5 ppm sulfur dioxide for 1 year and monkeys exposed to 1.3 ppm for 78 weeks. Decreased lung compliance and decreased pulmonary flow-resistance was seen in dogs exposed continuously to 5 ppm for 225 days.

Although there is no evidence that sulfur dioxide acts directly as a carcinogen, it may act as a promoter. Rats which inhaled 4 – 10 ppm sulfur dioxide (1-6 H/day, 5 days/week) and were intermittently exposed to benzo[a]pyrene (B[a]P) had a substantial increase in respiratory tract squamous cell carcinomas when compared to exposures to B[a]P) or SO_2 alone.

Mutagenic:
Genetic changes observed in mammalian, insect bacterial and yeast cell assay systems. Sulfur dioxide has failed consistently to induce gene toxicity in intact rodents.

Reproductive:
Experimental inhalation exposures of rats and mice at 1.5 to 32 ppm resulted in toxicity to both the male and female reproductive systems. Effects included menstrual cycle changes and toxic effects to testes. Developmental abnormalities were observed in newborn of exposed pregnant animals.

Ecological Information

Environmental Fate:
The average residence time of pollution sulfur is generally between one and five days depending on the climate of a region. Spring melts of accumulated winter snow packs may result in rapid short-term inputs of high sulfate, low pH water to freshwater systems with disastrous effects on fish.

Disposal Considerations

Do not attempt to dispose of waste or unused quantities in returnable cylinders. Return in the shipping container, *properly labeled, with any valve outlet plugs or caps secure and valve protection cap in place* to NorLab for proper disposal. Non-refillable containers should be vented in a well-ventilated area then disposed of in compliance with local regulations, or returned to NorLab.

Transportation Information

Parameter	United States DOT	Canada TDG
Proper Shipping Name:	Compressed gas, N. O. S., (sulfur dioxide, nitrogen)	Compressed gases, N. O. S.
Hazard Class:	2.2	2.2
Identification Number:	UN 1956	UN 1956
Shipping Label:	Non Flammable Gas	Non Flammable Gas

Regulatory Information

Sulfur dioxide is listed under the accident prevention provisions of section 112 (r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 5,000 pounds.

SARA Title III Notifications and Information:
Sulfur dioxide is listed as an extremely hazardous substance (EHS) subject to state and local reporting under Section 304 of SARA Title III (EPCRA). The presence of sulfur dioxide in quantities in excess of the threshold planning quantity (TPQ) of 500 pounds requires certain emergency planning activities to be conducted.

SARA Title III – Hazard Classes:
Acute Health Hazard
Chronic Health Hazard
Sudden Release of Pressure Hazard

California Proposition 65: This product does not contain ingredient(s) know to the State of California to cause cancer or reproductive toxicity.

Other Information

Compressed gas cylinders must not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

Disclaimer of expressed and implied warranties:
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