Emergency Contact: Chemtrec (800) 424-9300
Or NorLab (208) 336-1643

1125 West Amity Road
Boise, ID 83705
(208) 336-1643

Four Part Mix, 5 to 100 PPM Hydrogen Sulfide, 0.0001% to 2.5% Methane, 1 PPM to 1000 PPM Carbon Monoxide, 2% to 23% Oxygen in Nitrogen

MATERIAL SAFETY DATA SHEET

Identification

Product Name: 5 to 100 PPM Hydrogen Sulfide, 0.0001% to 2.5% Methane, 1 PPM to 1000 PPM Carbon Monoxide, 2% to 23% Oxygen in Nitrogen
Revision Date: 02/16/07
Last Review Date: 01/15/13
CAS Number: N/A
Chemical Family: Gas Mixture
Chemical Formula: H_2S, CH_4, CO, O_2 in N_2
Synonyms: Gas, Bump Gas, Calibration Gas Mixture, Four Part Mix
MSDS Identification Code/Number: 2310
Prepared By: Quality Dept.

Composition, Information on Ingredients

Exposure Limits[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} OR LC_{50} Route/Species
Hydrogen Sulfide Formula: H_2S CAS: 7783-06-4 RTECS#: MX1225000	0.0005% to 0.01% 5 PPM to 100 PPM	20 PPM Ceiling Concentration	10 PPM TWA 15 PPM STEL	LC_{50} 712 PPM Inhalation/Rat 1 Hr.
Methane Formula: CH_4 CAS: 0074-82-8 RTECS#: TX2275000	0.0001% to 2.5%	None Established	1000 PPM	Not Available
Carbon Monoxide Formula: CO CAS: 0630-08-0 RTECS#: FG3500000	0.0001% to 0.1%	TWA 50 PPM	25 PPM TWA	LC_{50} 3760 PPM / 1 Hr. Time Adjusted (Rat)
Oxygen Formula: O_2 CAS: 7782-44-7 RTECS#: RS206000	2.0% to 23%	None	None	Not Available
Nitrogen Formula: N_2 CAS: 7727-37-9 RTECS#: QW9700000	74.39% to 98.0%	None Established	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.

OSHO Regulatory Status: This material is classified as hazardous under OSHA regulations.

Hazards Identification

Emergency Overview:

Colorless non-flammable gas with a distinctive rotten egg like odor. Do not rely on smell to detect hydrogen sulfide because of olfactory fatigue. Exposure to low levels of hydrogen sulfide causes irritation of mucous membranes. Inhaled carbon monoxide binds to the blood hemoglobin, greatly reducing the red cell's ability to transport oxygen to body tissues. Effects may include headaches, dizziness, convulsions, loss of consciousness, and death. Mix may or may not have sufficient oxygen content to support life therefore mix should be treated as a simple asphxiant. 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

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	Reproductive Hazard	Mutagen
Yes	Yes	No
Synergistic Effects None known		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Exposure to 20-50 PPM hydrogen sulfide will cause eye irritation. Low to moderately high concentrations may cause painful conjunctivitis, photophobia, lacrimation and corneal opacity. Exposure to 50-100 PPM hydrogen sulfide has resulted in temporary damage to the corneal epithelium in dogs, cats, rabbits, and guinea pigs. Contact with rapidly expanding gas near the point of release may cause frostbite.

SKIN EFFECTS:
Contact with hydrogen sulfide in this product may cause severe pain itching and erythema. 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 of this product is unlikely but can cause irritation of the mucous membranes and gastrointestinal tract.

INHALATION EFFECTS:
Nitrogen acts as a simple asphyxiant displacing the oxygen content in the air necessary for life. The following effects of asphyxiation are representative and it is possible that none of these symptoms may occur: loss of balance or dizziness; tightness in the frontal area of the forehead; tingling of the tongue, fingertips or toes; weakened speech leading to the inability to utter sounds; rapid reduction in the ability to perform movements; reduced consciousness of surroundings; loss of tactile sensations; and heightened mental activity. Concentrations of 150 PPM hydrogen sulfide can cause upper respiratory tract irritation, olfactory nerve paralysis, and pulmonary edema with prolonged exposure. Concentrations of 200 PPM hydrogen sulfide may be life threatening. Exposure to non-fatal levels of hydrogen sulfide may result in coughing, lacrimation, mucous nasal discharge, depression, fluid sounds in the lungs, headache, sweating, vertigo, irritability, weakness confusion, delirium, convulsions and cyanosis. At higher exposures hydrogen sulfide may cause sudden collapse, anoxic convulsions, pulmonary edema, hemorrhages in various organs, degenerative changes in the liver and kidney, edema of the intestines and brain and/or rapid death. Inhaled carbon monoxide binds with blood hemoglobin to form carboxyhemoglobin. Carboxyhemoglobin can not take part in normal oxygen transport, greatly reducing the blood's ability to transport oxygen. Depending on levels and duration of exposure, symptoms may include headache, dizziness, heart palpitations, weakness, confusion, nausea, and even convulsions, eventual unconsciousness and death.

Medical Conditions Aggravated by Exposure:
Blood Disorders.

NFPA HAZARD CODES		HMIS HAZARD CODES		RATINGS SYSTEM
Health:	3 (4, as H_2S)	Health:	3 (4, as H_2S)	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight Hazard
Instability:	0	Physical Hazard:	3	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Hazard ratings are assigned in accordance with 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

Eyes:
PERSONS WITH POTENTIAL EXPOSURE TO HYDROGEN SULFIDE SHOULD NOT WEAR CONTACT LENSES.
In case of eye contact, immediately flush with low pressure, cool water for at least 15 minutes, opening eyelids to ensure flushing. Get immediate medical attention.

Skin:
Flush affected area with copious quantities of water. Remove contaminated clothing as rapidly as possible. If irritation persists, seek medical attention.

Ingestion:
Ingestion unlikely. 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. Conscious persons should be assisted to an uncontaminated area and treated with supplemental oxygen. Quick removal from the contaminated area is most important. Unconscious persons should be moved to and uncontaminated area and be given artificial respiration and oxygen at the same time. Seek immediate medical attention. The physician should be informed that the patient has inhaled quantities of hydrogen sulfide and carbon monoxide.

Fire Fighting Measures

Conditions of Flammability: Not Flammable		
Flash Point: None	Method: Not Applicable	Autoignition Temperature: None
LEL (%): Not Applicable	UEL (%): Not Applicable	
Hazardous combustion products: Sulfur dioxide, irritants, toxic gases		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

Fire and Explosion Hazards:
None

Extinguishing Media:
Use any extinguishing media suitable for the surrounding fire. Use water spray to cool fire-exposed containers.

Fire Fighting Instructions:
Stop the flow of gas if it can be done without risk. Continue to cool surrounding containers until well after flames are extinguished. Firefighters should wear a full-facepiece, 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 reenter hazard area until hydrogen sulfide 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 of 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

Handling and Storage Continued

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 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 (52^{0}C). 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 Pamphlet 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 and to maintain oxygen levels above 19.5%.

EYE/FACE PROTECTION:
Chemical safety goggles or safety glasses with face shield should be worn.

SKIN PROTECTION:
Protective gloves of neoprene, butyl rubber, PVC, or polyethylene should be worn.

RESPIRATORY PROTECTION:
A NIOSH/MSHA-approved full-facepiece SCBA operated in positive pressure 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) :	Not available	
Evaporation point :	Not Available	
Boiling point :	Not Available	^{o}F ^{o}C
Freezing point :	Not Available	^{o}F ^{o}C
pH :	Not Applicable	
Specific gravity :	Not Available	
Oil/water partition coefficient :	Not Available	
Solubility (H20) :	Slightly soluble	
Odor threshold :	Not Applicable	
Odor and appearance :	Colorless gas/vapor. Characteristic hydrogen sulfide - rotten egg odor	

Stability and Reactivity

Stability:
Stable under normal conditions.

Incompatible Materials:
All flammable materials. Hydrogen sulfide will react with brass materials with copper sulfide as a reaction product.

Hazardous Decomposition Product:
Oxides of sulfur

Hazardous Polymerization:
Will not occur

Toxicological Information

Eye Effects:
Low concentrations of hydrogen sulfide will generally cause irritation to the conjunctiva. Repeated exposure to low concentrations is reported to cause conjunctivitis, photophobia, corneal bullae, tearing, pain and blurred vision.

Skin Effects:
May irritate the skin upon contact.

Acute Oral Effects:
Ingestion is considered unlikely. However, hydrogen sulfide will cause irritation of mucous membranes, causing a burning feeling with excess salivation likely. Irritation of the gastrointestinal tract may also occur.

Acute Inhalation Effects:
Continuous exposure to low (15 to 50 PPM) concentrations of hydrogen sulfide will generally cause irritation to mucous membranes, and may also cause headache, dizziness or nausea. Olfactory fatigue or paralysis of smell is also possible; thus detection of hydrogen sulfide by its odor is not considered adequate. Higher concentrations (2000 to 3000 PPM) may result in respiratory arrest leading to coma or unconsciousness. Exposures for more than 30 minutes at concentrations greater than 700 PPM have been fatal.

Hydrogen sulfide should be regarded as highly toxic. Toxicologically, it reacts with enzymes in the bloodstream and inhibits cellular respiration resulting in pulmonary paralysis, sudden collapse and death. This effect overshadows the irritant properties.

Ecological Information

Environmental Fate:
Hydrogen sulfide does not absorb solar radiation and therefore does not undergo photolysis or photochemical reaction with oxygen. Primary chemical transformation of hydrogen sulfide in the atmosphere is oxidation via oxygen containing radicals. The persistence of hydrogen sulfide in the atmosphere is dependent on season, latitude, and atmospheric conditions, ranging from 1 to 40 days with decreased temperatures and decreased levels of hydroxide in northern regions increasing residence time. In soil and water hydrogen sulfide is oxidized to elemental sulfur by microorganisms via oxidization-reduction reactions which form part of the global sulfur cycle.

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, (Hydrogen Sulfide, Nitrogen)	Compressed gas, 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

SARA Title III Notifications and Information:
This product contains hydrogen sulfide (CAS No.: 7783-06-4) which is listed under SARA 313 with a de minimus concentration of 1%; under SARA 304, CERCLA with a reportable quantity of 100 pounds, and is a SARA 302, Extremely Hazardous Substance with a Threshold Planning Quantity of 500 pounds.

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

California Proposition 65:
This product contains carbon monoxide, which the state of California has listed as having developmental toxicity.

Other Information

Reference Documentation:
Many metals corrode rapidly with wet hydrogen sulfide. Anhydrous hydrogen sulfide can be handled in carbon steel, aluminum Inconel®, Stellite® and 304 and 316 stainless steels. Avoid hard steels, which are highly stressed since they may be susceptible to hydrogen embrittlement from hydrogen sulfide.

Compressed gas cylinders shall 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.

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