District I
1625 N French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised October 10, 2003

Submit 2 Copies to appropriate District Office in accordance with Rule 116 on back side of form

Release Notification and Corrective Action

30-039-29367

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company **Williams Production**	Contact **Michael K. Lane**
Address **PO Box 640**	Telephone No. **505-634-4219**
Facility Name **Rosa Unit #383 (API: 30-039-29367)**	Facility Type **Well Site**

Surface Owner **USFS**	Mineral Owner **BLM**	Lease No.

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
P	**29**	**31 N**	**04W**					**Rio Arriba**

Latitude 36.86664 **Longitude** -107.27622

NATURE OF RELEASE

Type of Release H2S	Volume of Release >70ppm	Volume Recovered None
Source of Release Wellhead during completion	Date and Hour of Occurrence 09/14/11 - 10:40AM	Date and Hour of Discovery Same
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? Brandon Powell, NMOCD Inspector & Bill Leise, BLM-FFO	
By Whom? Myke Lane	Date and Hour Sep 16 11:00AM	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.

Describe Cause of Problem and Remedial Action Taken. *During re-entry of Rosa 383 H2S monitors alarmed at 70 ppm. Job was stopped and workers moved out of area to muster point on location. The completion water was suspected as the possible source. The well was chemically treated and Re-entry operations reinitiated on 9/16/11. Once again H2S was identified with concentrations over 300ppm measured at the muffler. The well was shutin and operations suspended. NMOCD, BLM and the USFS were notified by phone. A H2S contingency plan was developed in accordance with NMOCD rule 19.15.11.9 NMAC. Following consultation with NMOCD, Williams has resumed the re-entry involving the wellbore cleanout following a frac stimulation. As sand bridges are cleared residual H2S has been measured at the surface, and when this happens operations are suspended, well shutin and chemically treated, and once monitoring at the surface indicates the H2S has been treated re-entry continues.*

Williams has also initiated an enhanced pre-treatment program for all water to be used for well stimulation and workovers. Water haulers are treating each load following pickup and prior to delivery in storage tanks. to treat all completions

Describe Area Affected and Cleanup Action Taken.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations

Signature:	OIL CONSERVATION DIVISION
Printed Name: Michael K. Lane	Approved by District Supervisor:
Title: SJB EH&S Specialist	Approval Date: 10/25/11 Expiration Date:
E-mail Address: myke.lane@williams.com	Conditions of Approval: Attached ☐
Date: 10/10/11 Phone: (505) 330-3198	

* Attach Additional Sheets If Necessary

nJK1129856876

RECEIVED
OCT 2011
OIL CONS. DIV. DIST. 3

25

Energy Services
Exploration & Production
PO Box 640
Aztec, NM 81137
505/333-1800
505/333-1805 Fax

Sep 30, 2011

Mr. Brandon Powell
State of New Mexico- Oil Conservation Division
Environmental Specialist
1000 Rio Brazos Road
Aztec, New Mexico 87410

RE: Rosa Hydrogen Sulfide Contingency Plan
Williams Production Co, LLC, (OGRID 120782)

Please accept this correspondence as Williams Production Company, LLC (Williams') Hydrogen Sulfide (H2S) Contingency Plan to meet NMOCD Rule 19.15.11.9 NMAC.

This contingency plan has been developed following the recent discovery of the presence of Hydrogen Sulfide(H2S) in significant quantities during Completion activities on the Rosa #383 and during routine production activities on the Rosa #108. We have not been able to definitively confirm the source, but suspect stimulation water. In response, Williams has initiated the following H2S Contingency Plan to manage these incidents:

Emergency Procedures:
If H2S is suspected wells and piping will be secured and shut-in until the actual levels of H2S are determined. Multi-gas meters are used by all field personnel and contractors during well servicing and production operations. If a concentration of 10 PPM of greater is measured, personnel are to immediately evacuate the area moving up and cross wind from the apparent source.

Upon discovery Williams has contracted with McGuire Industries to provide and implement third-party H2S Site Management. This includes but is not limited to evacuation, site security/road-blocks/public and notifications. McGuire will to provide qualified and trained personnel, and any needed safety equipment. Safety equipment to include but not be limited to the following:

6 bottle Grade D breathing air work line cascade unit
2 -30 minute rescue SCBA
Remote H2S and SO2 monitors with automatic audible and visual alarms
8 loose fitting grade D breathing air escape hoods
12 personal H2S monitors
4 hand held 4 gas monitors
First aid kit
Wind sock
Weather station
2 hand held air horn alarms
Cell phone

Attached is the Plan and Procedures to be followed by McGuire and affected Williams and Contractor personnel for the incidents noted.

Williams One Plan will be followed which includes emergency contract numbers, public agencies, local governments, and other appropriate public authorities.

Refer to the attached site details regarding affected public areas and public roads.

The attached Emergency Phone Contact list will be used to contact Company, Regulatory Agencies and Emergency Responders.

Characteristics of H2S (and Sulfur Dioxide SO2):
See attached MSDSs

Maps:
See attached Site Details. Note affected public area and roads are noted, and the exposure radius for the affected sites is calculated per 19.15.11.7.K.

Training:
All Williams and Contractor personnel will have a minimum training in H2S awareness level H2S Training. McGuire personnel will be certified in H2S Operation and Emergency Management. Training records will be made available upon request.

Public Emergency Management Coordination:
As outlined in the Williams One Plan, the appropriate response agencies will be notified in the case of any unforeseen significant incident which may require an emergency response or other resources not current employed by Williams.

Activation Levels:
Upon discovery the initial activation level is 10 ppm. Site operations and management will be modified to ensure worker and public safety.

Once accurate measurements can be taken of source gas and exposure radius calculated this activation level will be modified to the following: 100 ppm in public areas or 500 ppm at a public road.

A Please advise us additional information is needed in this matter. Thank you for your consideration.

Respectfully submitted,

Michael K. Lane, PE
EH&S Sr. Specialist and Team Lead
Williams Production Co, LLC
San Juan Basin Operations

Encl: Emergency Phone List
H2S & SO2 MSDS
Rosa #108 Site Detail
Rosa #383 Site Detail
McGuire SOP

WILLIAMS EXPLORATION & PRODUCTION

EMERGENCY CONTACT NUMBERS

AZTEC OFFICE
PO Box 640/721 So. Main
Aztec, NM 87410
(505) 634-4200

Contact	Title	Office	Cell	Pager	
Jason Richardson	Production Supervisor	505-333-1812	505-320-7916		
Ron Cochran	Materials Manager	505-333-1831	505-320-7065		
Cyd Shepard	Production Supervisor	505-333-1877	505-330-0222		
Larry Higgins	Permitting Supervisor	505-333-1808	505-320-4314		
Sterg Katirgis	Production Manager	505-333-1832	505-486-4751		
Tommy Darrell	Sourcing Specialist	505-333-1837	505-947-1174		
Walt Snyder	Production Supervisor	505-333-1838	505-486-3270		
Russ Knight	Production Supervisor	505-333-1842	505-486-1826		
Myke Lane	EH&S Team Lead	505-333-1819	505-330-3198		
Mark Lepich	Construction Supervisor	505-333-1803	505-320-1338		
Heather Riley	Regulatory Specialist SR	505-333-1822	970-749-8747		
Vanessa Fields	EHS Coordinator	505-333-1841			
Bill Robertson	Safety Specialist II	505-333-1845	505-419-6137		
Randy VanDenBerg	Production Superintendent	505-333-1801	970-759-0501		
Jim McWilliams	Automation Supervisor	505-333-1820	505-320-2239		

TULSA OFFICE

Contact	Title	Office	Cell	Pager	
Bob Revella	Regional VP	918-573-5147	918-740-3764		
Ken McQueen	Dir San Juan E&P	918-573-2889	918-232-3081		
Bobby Goodwin	Engineering Supervisor	918-573-0195	918-688-2373		
Roxanne Roberts	EH&S Manager	918-573-0195	918-688-2373		
Kelly Swan	Public Relations	918-573-6932	918-629-1037		
Michael Andrews	Production Engineer	918-573-0711	918-720-5495		
Jamie Sampayo	Production Engineer	918-573-1492	918-261-5658		
Kirk Place	Petroluem Engineer	918-573-6250	918-671-7786		
Gary Sizemore	Drilling Engineer	918-573-8776	918-760-8093		

Williams Midstream

Contact	Title	Office	Cell	Pager	
Lloyd Bell	WFS-Pipeline COM	505-632-4604	505-486-2637	505-324-4445	
Barbara Jackson	Ops &Maint Coord	505-634-4954	505-486-3245		
	WFC Digout Hotline	505-632-4750			
	FCA Dispatch	505-632-4632			

Enterprise Emergency Management 1-888-465-9515
Gas Control Tulsa 1-800-635-7400
National Responce Center 1-800-424-8802

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WILLIAMS EXPLORATION & PRODUCTION

COLORADO EMERGENCY NUMBERS

FIRE DEPARTMENTS

Durango Fire Department	970-385-2900	Durango
BIA Fire Management	970-563-4571	
Durango Fire Dispatch	970-385-1324	Durango
Southern Ute Fire Department	970-563-4401	Ignacio

HOSPITALS/AMBULANCE

Mercy Medical Hospital	970-247-4311	Durango
*Life Flight Helicopter	970-247-4311	Durango
Colorado Pioson Control	303-739-1123	Aurora
Ignacio Emergency Services	970-563-4401	Ignacio

*Emergency Room will answer at Centura-Mercy Hospital in Durango. This helicopter is only available if not in use when the call is received.

SHERIFF/POLICE

Colorado State Patrol	970-249-4392	
Ignacio Police Department	970-563-4206	Ignacio
LaPlata County Sheriff	970-385-2900	Durango
Southern Ute Police Department	970-563-4401	Ignacio
Southern Ute Energy Department	970-563-0140	Ignacio
Southern Ute Indian Tribe (Rick Gurule)	970-563-0133 (AFTER HOURS 970-749-2614)	Ignacio

REGULATORY AGENCIES

COGCC	970-259-4587	Durango
BIA-So. Ute Agency (Jim Formea & Dee Olguin)	970-563-4514	Ignacio
BLM (Dave Swanson)	970-385-1370	Durango
So. Ute Environmental Programs (Gary Vance)	970-563-0135	Ignacio
So. Ute Energy Resources	970-563-5550	Ignacio
BOR - Navajo Reservoir (NM & CO)	970-385-6554	Durango

NEW MEXICO EMERGENCY NUMBERS

FIRE DEPARTMENTS

San Juan County Dispatch	911	County Wide
San Juan County Dispatch	505-334-6622	County Wide
FCA Fire Dispatch (BML/Forest Service)	505-632-1963	
Jicarilla Apache Fire Department	505-759-3963/3964	Dulce

HOSPITALS/AMBULANCE

Aztec Emergency Services	505-334-6622	Aztec
Univesity of New Mexico Life Flight Helicopter	800-633-5438	Albuquerque
San Juan Regional Medical Center	505-325-5011	Farmington

SHERIFF/POLICE

New Mexico State Police	505-325-7547	Farmington
Rio Arriba County Sheriff	505-588-7271	Tierra Amarilla
San Juan County Sheriff	505-334-6107	Aztec
Bloomfield Police	505-632-6311	Bloomfield

REGULATORY AGENCIES

NMOCD	505-334-6178	Aztec
BLM Farmington Field Office	505-599-8900	Farmington
USFS-Carson	505-632-2956	Bloomfield
Jicarilla Apache Nation	575-759-3485 EXT.228	Dulce
BLM Jicarilla Area (Bryce Hammond)	505-320-9741 (575-759-1321)	Dulce

Revised 9/30/2011

WILLIAMS EXPLORATION & PRODUCTION

CONTACT NUMBERS

DRILLING/COMPLETION/WORKOVER				
San Juan Basin	**Title**	**Office**	**Cell**	**e-mail**
Patrice Brown	**Drilling Consultant**	**505-334-4019 (fax)**	**505-320-7439**	tdci@arcnet.com
Robert Brown	**Drilling Consultant**	**505-320-3533**	**505-320-2249**	rbdevildog@arcnet.com
Glenn Gathings	**Drilling Consultant**	**505-215-9201**	**505-215-4635**	Gmagic93@aol.com
Harmon Cockrell	**Drilling Consultant**		**505-801-5681**	hclobo1@yahoo.com
Tom Arnold	**Drilling Consultant**		**505-801-0826**	ita2@earthlink.net
Buddy Banks	**Consultant MVCI**		**505-320-7524**	bbankssdc@yahoo.com
Chuck Banks	**MVCI - Safety Rep**	**505-325-5320**	**505-793-1635**	cbanks@mvci.biz
Tim Myers	**Consultant MVCI**		**505-215-4218**	timmeyers@mvci.biz
Craig Ward	**Consultant MVCI**		**505-793-3099**	cwar624@aol.com
Mike R Jones	**Consultant MVCI**		**505-330-5884**	jones1506@hotmail.com
Mitch Chavez	**Consultant MVCI**		**505-330-6932**	chavez124@q.com
Weldon Higgins	**Consultant MVCI**	**505-320-4871**	**505-325-5447**	weldonhiggins@mvci.biz
Gene Current	**Consultant**		**505-330-4592**	elhefey@msn.com
Larry Candelaria	**Consultant**		**505-330-7065**	lrcandelariaconsulting@yahoo.co
Tom Mitchell	**Construction Inspector**		**801-691-9790**	golf.mitch@yahoo.com

WPX Incident Reporting System

https://williams.kminnovations.net/apps/Login/UserLogin.aspx?ReturnUrl=%2fapps%2fDefault.aspx

EMERGENCY RESPONSE				
Service Type	**Name**	**Office**	**Comments**	**e-mail**
H2S Management	McGuire Industries	**505-325-6232**		mcguireindustries.com
Spill and HazOp	ENVIROTECH Inc.	**505-632-0615**		
Spill and HazOp	***iina' ba', Inc.***	**505-327-1072**	**Native Pref.**	
SPCC Planning	***Tiis Y a' To'h***	**(505) 793-4994**	**Native Pref.**	lavina.lamone@tiisyatoh.com
Stormwater/Construction Maintenance	**ADOBE**	**505-632-1486**		
Frac Chemicals	**Halliburton**	**580-251-4335**	**Chemical Compliance**	fdunexchem@halliburton.com
HV Electrical	**Pumps & Service**	**505-327-6138**	**Hi Voltage Service**	

Revised 9/30/2011

AIR PRODUCTS

MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: **Hydrogen Sulfide**
CHEMICAL NAME: Hydrogen sulfide **FORMULA:** H_2S
SYNONYMS: Sulfuretted Hydrogen; Hydrogen Sulphide; Hydrosulfuric Acid; Sulfur Hydride; Sewer Gas

MANUFACTURER: **Air Products and Chemicals, Inc.**
7201 Hamilton Boulevard
Allentown, PA 18195-1501

PRODUCT INFORMATION: (800) 752-1597

MSDS NUMBER: 1010 **REVISION:** 6
REVIEW DATE: December 1999 **REVISION DATE:** December 1999

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hydrogen Sulfide is sold as pure product (> 99%).

CAS NUMBER: 7783-06-4
EXPOSURE LIMITS:
OSHA: PEL = 20 ppm (Ceiling) **ACGIH:** TWA = 10 ppm STEL = 15 ppm **NIOSH:** REL = 10 ppm Ceiling (10 minutes) IDLH = 100 ppm

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW

Hydrogen Sulfide is a toxic, flammable, colorless, liquefied compressed gas packaged in cylinders under its own vapor pressure of 248.9 psig at 70 °F. It poses an immediate fire and explosion hazard when mixed with air at concentrations exceeding 4.0%. The gas is heavier than air, and may spread long distances. Distant ignition and flashback are possible. Hydrogen Sulfide has a distinct "rotten-egg" smell. However, odor is not an effective warning of the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations may cause olfactory fatigue. Exposure to Hydrogen Sulfide concentrations greater than 500 ppm can result in unconsciousness, coma, and death. Contact with the liquid (or rapidly expanding gases) may cause frostbite. Self-contained breathing apparatus (SCBA) required for rescue workers.

EMERGENCY TELEPHONE NUMBERS
(800) 523-9374 **Continental U.S., Canada, and Puerto Rico**
(610) 481-7711 **Other locations**

ACUTE POTENTIAL HEALTH EFFECTS:

ROUTES OF EXPOSURE:

EYE CONTACT: Inflammation and irritation of the eyes can occur at very low airborne concentrations (less than 10 ppm). Symptoms may include tearing, burning, pain when looking at light (photophobia), and blurred vision. Exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. In addition, contact with liquid (or rapidly expanding gas) may cause irritation and frostbite.

INGESTION: Ingestion of Hydrogen Sulfide is not a likely route of industrial exposure.

INHALATION: Inhalation of Hydrogen Sulfide can cause deadening of sense of smell, dizziness, headache, nausea and respiratory tract irritation. Exposure to Hydrogen Sulfide concentrations greater than 500 ppm can result in respiratory arrest, coma, unconsciousness and death. Continuous inhalation of low concentrations may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of Hydrogen Sulfide. Severe exposures which do not result in death may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage.
SKIN CONTACT: May cause irritation. Contact with liquid (or rapidly expanding gas) may cause irritation and frostbite.

POTENTIAL HEALTH EFFECTS OF REPEATED EXPOSURE:

ROUTE OF ENTRY: Inhalation, skin contact

SYMPTOMS: Chronic health effects caused by repeated low-level exposure to Hydrogen Sulfide have not been established. Repeated low level skin exposure may cause dermatitis.

TARGET ORGANS: Eyes, skin, respiratory and central nervous systems.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Acute or chronic respiratory conditions, neurological or eye disorders may be aggravated by over-exposure to Hydrogen Sulfide.

CARCINOGENICITY: This product is not listed as a carcinogen or potential carcinogen by NTP, IARC, or OSHA.

SECTION 4. FIRST AID MEASURES

EYE CONTACT: Flush eyes with plenty of lukewarm water for several minutes. Seek medical attention immediately.

INGESTION: Ingestion is an unlikely route of exposure for Hydrogen Sulfide.

INHALATION: Remove person to fresh air. If not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

SKIN CONTACT: If liquid Hydrogen Sulfide comes in contact with skin, or if irritation of the skin develops after exposure to gas, immediately begin decontamination with running water. Remove contaminated clothing and flush with plenty of lukewarm water for several minutes. Seek immediate medical attention.

NOTES TO PHYSICIANS: Administer oxygen, if necessary and treat symptoms. Be observant for initial signs of pulmonary edema.

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT:	AUTOIGNITION:	FLAMMABLE RANGE:
Not applicable	500 °F (260 °C)	(LEL): 4.0% (UEL): 44.0%

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, water.

SPECIAL FIRE-FIGHTING PROCEDURES: Evacuate all personnel from area. If possible, without risk, shut off source of gas, then fight fire according to types of materials burning. Extinguish fire only if gas flow can be stopped. This will avoid possible accumulation and reignition of a flammable gas mixture. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. Self-contained breathing apparatus (SCBA) required.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Most cylinders are designed to vent contents when exposed to elevated temperatures. Pressure in a cylinder can build-up due to heat and it may rupture if pressure relief devices should fail to function. An extreme explosion hazard exists in areas in which the gas has been released but the material has not yet ignited. The gas is heavier than air, and may spread long distances. Distant ignition and flashback are possible.

HAZARDOUS COMBUSTION PRODUCTS: Oxides of sulfur

SECTION 6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate immediate area. Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. Shut off source of leak, if possible. Isolate any leaking cylinder. If leak is from container, pressure relief device or its valve, contact

your supplier. If leak is in user's system, close cylinder valve, safely vent pressure and purge with inert gas before attempting repairs. Monitoring should be done for the levels of Hydrogen Sulfide. The concentration of Hydrogen sulfide must be below levels listed in Section 2 (Composition / Information on Ingredients) and the atmosphere must have at least 19.5% oxygen before personnel can be allowed in the area without self-contained breathing apparatus (SCBA). Combustible vapor levels must be below 0.40%, which is 10% of the LEL of Hydrogen Sulfide, prior to entry.

SECTION 7. HANDLING AND STORAGE

STORAGE: Store cylinders in a well-ventilated, secure area, protected from the weather. Secured cylinders should be stored up-right with valve outlet seals and valve protection caps in place. There should be no sources of ignition. All electrical equipment should be explosion-proof in the storage areas. Storage areas must meet National Electrical Codes for Class 1 hazardous areas. Flammable storage areas must be separated from oxygen and other oxidizers by a minimum distance of 20 ft. or by a barrier of non-combustible material at least 5 ft. high, having a fire resistance rating of at least 1/2 hour. Post "No Smoking or Open Flames" signs in the storage and use areas. Hydrogen Sulfide detectors should be installed in or near areas where Hydrogen Sulfide is being used or stored. Do not allow storage temperature to exceed 125 °F (52 °C). Storage should be away from heavily traveled areas and emergency exits. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Local codes may have special requirements for toxic gas storage.

HANDLING: Do not drag, roll, slide or drop cylinder. Use a suitable hand truck designed for cylinder movement. Never attempt to lift a cylinder by its cap. Secure cylinders at all times while in use. Use a pressure reducing regulator to safely discharge gas from cylinder. Use a check valve to prevent reverse flow into cylinder. Never apply flame or localized heat directly to any part of the cylinder. Do not allow any part of the cylinder to exceed 125 °F (52 °C). Once cylinder has been connected to properly purged and inerted process, open cylinder valve slowly and carefully. If user experiences any difficulty operating cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps. All piped systems and associated equipment must be grounded. Electrical equipment should be non-sparking or explosion-proof. If appropriate, install automatic monitoring equipment to detect the level of oxygen and the presence of potentially explosive air-gas mixtures.

SPECIAL PRECAUTIONS: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Hydrogen Sulfide could occur without any significant warning symptoms. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize the release of Hydrogen Sulfide.

Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, Inc. (telephone 703-412-0900) pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers.* Local regulations may require specific equipment for storage and use.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

VENTILATION: Because of the hazards associated with Hydrogen Sulfide, control measures such as ventilated enclosures may be necessary. Provide explosion-proof ventilation sufficient to ensure Hydrogen Sulfide does not reach exposure limits listed in Section 2. (Composition / Information on Ingredients). Local exhaust ventilation is preferred.

RESPIRATORY PROTECTION:

Emergency Use: Self-contained breathing apparatus (SCBA) or positive pressure air line with full-face mask and escape pack should be used in areas where the Hydrogen Sulfide concentration is below 0.40%, which is 10% of the LEL of Hydrogen Sulfide, and exceeds permissible exposure limits. High concentrations may be within the flammable range and must not be entered.

EYE PROTECTION: Safety glasses for handling cylinders. Chemical goggles with full faceshield for connecting or disconnecting cylinders.

SKIN PROTECTION: Butyl rubber, chlorinated polyethylene, neoprene, nitrile, or polyvinyl rubber gloves. Fire-resistant gloves and clothing in emergency situations. Leather gloves for handling cylinders.
OTHER PROTECTIVE EQUIPMENT: Safety shoes are recommended when handling cylinders. Static-resistant clothing is recommended. Safety shower and eye wash station should be readily available.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE, ODOR AND STATE: Colorless gas with odor of "rotten eggs" .
MOLECULAR WEIGHT: 34.08
BOILING POINT (1 atm): -76.4 °F (-60.2 °C)
SPECIFIC GRAVITY (also called vapor density) (air = 1): 1.17
SPECIFIC GRAVITY (of liquid) (At 59 °F (15 °C)): 0.79
FREEZING/MELTING POINT: -122 °F (-85.6 °C)
VAPOR PRESSURE (At 70 °F (21.1°C): 248.9 psig
GAS DENSITY (At 68 °F (20 °C) and 1 atm): 0.089 lb/ft^3
SOLUBILITY IN WATER (At 68 °F (20 °C): 0.0317 lb/gal

SECTION 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable
CONDITIONS TO AVOID: Cylinders should not be exposed to temperatures in excess of 125 °F (52 °C).
INCOMPATIBILITY (Materials to Avoid): Oxidizing agents, organic peroxides, alkaline materials, metals (i.e. copper, lead), and metal oxides. Hydrogen Sulfide reacts with most metals to form metal sulfides.
REACTIVITY:

A) **HAZARDOUS DECOMPOSITION PRODUCTS:** Hydrogen and sulfur
B) **HAZARDOUS POLYMERIZATION:** Will not occur

SECTION 11. TOXICOLOGICAL INFORMATION

LC_{50} (Inhalation): 587 ppm (rat, 2 hour); 444 - 501 ppm (rat, 4 hour); 335 ppm (rat, 6 hour)
LD_{50}, (Oral): Not available
LD_{50} (Dermal): Not available
SKIN CORROSIVITY: Hydrogen Sulfide is irritating to the skin.
ADDITIONAL NOTES: Rats and mice that were exposed for 90 days to Hydrogen Sulfide at a concentration of 80 ppm had significantly decreased body weights compared to controls. Rats exposed to 80 ppm had depressed brain weights compared to controls. The only histological finding was inflammation of the nasal mucosa.
Hydrogen Sulfide was not mutagenic in a bacterial (S. typhimurium) assay.

SECTION 12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY: Currently, the following aquatic toxicity data are available for Hydrogen Sulfide:

TLm (Asellussp) 96 hours = 0.111 mg/L
TLm (Cranfgonyx sp) 96 hours =1.07 mg/L
TLm (Gammarrus) 96 hours = 0.84 mg/L
LC_{50} (fly inhalation) 960 minutes = 380 mg/m^3
LC_{50} (fly inhalation) 7 minutes = 1500 mg/m^3
TLm (Lepomis macrochirus, bluegill sunfish) 96 hours = 0.0478 mg/L
TLm (*Lepomis macrochirus*, bluegill sunfish) 96 hours = 0.0448 mg/L at 21-22 °C
TLm (*Pimephlaes promelas*, fathead minnow) 96 hours = 0.0071-0.55 mg/L
TLm (*Salvenillis foninalis*, brook trout) 96 hours = 0.0216-0.038 mg/L at 8-12.5 °C

MOBILITY: Hydrogen Sulfide will not be mobile in soil.
PERSISTENCE AND BIODEGRADABILITY: Persistence: Converts to elemental sulfur upon standing in water. Biodegradation: Microorganisms in soil and water are involved in oxidation-reduction reactions that oxidize hydrogen sulfide to elemental sulfur. Members of the genera Beggiatoa, Thioploca, and Thiotrix function in transition zones between aerobic and anaerobic conditions where both molecular oxygen and hydrogen sulfide are found. Also, some photosynthetic bacteria oxidize hydrogen sulfide to elemental sulfur. Members of the families Chlorobiaceae and

Chromatiaceae (purple sulfur bacteria) are obligate aerobes and are phototropic, and are found in waters with high H_2S concentrations. The interactions of these organisms form part of the global sulfur cycle.
POTENTIAL TO BIOACCUMULATE: Hydrogen Sulfide does not have bioaccumulation or food chain contamination potential.
REMARKS: Hydrogen Sulfide is not a Class I or Class II ozone depleting chemical (40 CFR Part 82).

SECTION 13. DISPOSAL CONSIDERATIONS

UNUSED PRODUCT / EMPTY CONTAINER: Return container and unused product to supplier. Do not attempt to dispose of residual or unused quantities.
DISPOSAL INFORMATION: Shall be done in accordance with Federal, State and local regulations. Wastes containing this material may be classified by EPA as a hazardous waste by characteristic (such as Ignitability, Corrosivity, Toxicity, Reactivity). Waste streams must be characterized by the user to meet Federal, State and local requirements.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: Hydrogen Sulfide
Poison - Inhalation Hazard, Zone B
HAZARD CLASS: 2.3
IDENTIFICATION NUMBER: UN1053
SHIPPING LABEL(s): Poison gas, Flammable gas
PLACARD (All quantities): Poison Gas

ADDITIONAL MARKING: Hydrogen Sulfide is also a hazardous substance regulated by the EPA. When shipping quantities of 100 lbs. or more in one cylinder, add the prefix "RQ" to the DOT shipping name on the documentation and clearly mark "RQ" on the cylinder near the label.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure upright position in a well-ventilated truck. Never transport in passenger compartment of a vehicle. Ensure cylinder valve is properly closed, valve outlet cap has been reinstalled, and valve protection cap is secured before shipping cylinder.

CAUTION: Compressed gas cylinders shall not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with the owner's written consent is a violation of Federal law (49 CFR 173.301).

NAERG (NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK) #: 117

SECTION 15. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS:
EPA - ENVIRONMENTAL PROTECTION AGENCY:

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1990 (40 CFR Parts 117 and 302)
Reportable Quantity (RQ): 100 lbs (45.4 kgs)

SARA TITLE III: Superfund Amendment and Reauthorization Act

SECTIONS 302/304: Emergency Planning and Notification (40 CFR Part 355)
Extremely Hazardous Substances: Hydrogen Sulfide is listed.
Threshold Planning Quantity (TPQ): 500 lbs (227 kgs)
Reportable Quantity (RQ): 100 lbs (45.4 kgs)

SECTIONS 311/312: Hazardous Chemical Reporting (40 CFR Part 370)
IMMEDIATE HEALTH: Yes
DELAYED HEALTH: No
PRESSURE: Yes
REACTIVITY: Yes
FIRE: Yes

SECTION 313: Toxic Chemical Release Reporting (40 CFR 372)
This product does not require reporting under Section 313.

CLEAN AIR ACT:

SECTION 112 (r): Risk Management Programs for Chemical Accidental Release (40 CFR Part 68)

Hydrogen Sulfide is listed as a regulated substance.
Threshold Quantity (TQ): 10,000 lbs (4,535 kg)

TSCA: Toxic Substances Control Act

Hydrogen Sulfide is listed on the TSCA Inventory.

OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR Part 1910.119: Process Safety Management of Highly Hazardous Chemicals.

Hydrogen Sulfide is listed as a highly hazardous substance.
Threshold Quantity (TQ): 1500 lbs (681 kgs)

STATE REGULATIONS:

CALIFORNIA:

Accidental Release Prevention Program: Threshold Quantity (TQ): 500 lbs (227 kgs)

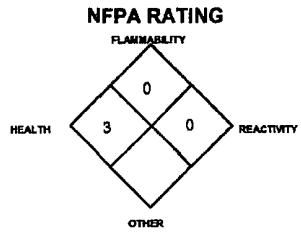
Proposition 65: Hydrogen Sulfide is not a listed substance which the State of California requires warning under this statute.

NEW JERSEY:

Toxic Catastrophe Prevention Act: Registration Quantity (RQ): 500 lbs (227 kgs)

SECTION 16. OTHER INFORMATION

NFPA RATINGS:		HMIS RATINGS:	
HEALTH:	= 4	HEALTH:	= 2
FLAMMABILITY:	= 4	FLAMMABILITY:	= 4
REACTIVITY:	= 0	REACTIVITY:	= 0
SPECIAL:	None		



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:	**SULFUR DIOXIDE - SO_2**
	Document Number: P-0047
PRODUCT USE:	For general analytical/synthetic chemical uses.
SUPPLIER/MANUFACTURER'S NAME:	MESA Specialty Gases & Equipment
ADDRESS:	3619 Pendleton Avenue, Suite C Santa Ana, CA 92704
BUSINESS PHONE:	1-714-434-7102
EMERGENCY PHONE:	INFOTRAC: 1-800-535-5053
DATE OF PREPARATION:	May 20, 1996
SECOND REVISION:	January 23, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	OTHER
Sulfur Dioxide	7446-09-5	> 99.98 %	2, A4 (Not Classifiable as Human Carcinogen)	5	5 2 (Vacated 1989 PEL)	5 (Vacated 1989 PEL)	100	NIOSH REL: 2 ppm TWA; 5 ppm STEL DFG-MAK: 2 ppm TWA
Maximum Impurities		< 0.02%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Sulfur Dioxide is a colorless, non-flammable, toxic gas with a distinct odor similar to burning sulfur. Sulfur Dioxide is shipped as a liquid which rapidly turns into a gas at standard atmospheric temperatures and pressures. Sulfur Dioxide is irritating to the respiratory system and to contaminated skin and eyes. Exposure to high concentrations of this gas may be fatal. Contact with rapidly expanding gases, or contact with the liquid, may cause frostbite. The gas reacts with water or moisture to generate sulfurous acid, which can also be corrosive to contaminated tissue.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for Sulfur Dioxide is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Exposure to Sulfur Dioxide gas in low concentrations produces an irritating effect on the mucous membranes of the eyes, nose, throat, and lungs due to the formation of sulfurous acid when it comes into contact with moist tissues or moist air. Acute exposure through inhalation may result in dryness and irritation of the nose and throat, choking, coughing, and bronchospasm. Severe overexposure may cause death through systemic acidosis, pulmonary edema, or from respiratory arrest. High concentrations of Sulfur Dioxide gas may cause an oxygen deficient atmosphere. Exposure to high concentrations may cause unconsciousness, and under some circumstances, death.

Prolonged or repeated overexposures may cause impaired lung function, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell. Repeated over exposures to Sulfur Dioxide can also result in dental erosion and gum disorders.

SKIN and EYE CONTACT: The gas may be irritating to the skin, especially in a moist environment. Symptoms of skin overexposure may include scratchiness, pain, and redness. If Sulfur Dioxide contaminates the eyes, damage to eye tissue will result in pain, inflammation, and potentially, blindness. Liquid Sulfur Dioxide will be very corrosive to contaminated skin and eye tissue, producing the same symptoms as described for the gas, but with the on-set of symptoms occurring more rapidly. Eye injury from contact with liquid Sulfur Dioxide may not be immediately noticed because of the damage which can occur to the optical nerves. Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	3
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		H

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

OTHER POTENTIAL HEALTH EFFECTS: While ingestion is highly unlikely, ingestion of Sulfur Dioxide can damage the tissues of the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of Sulfur Dioxide can be fatal. Additionally, aspiration by inhalation is possible, causing chemical pneumonia or death.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. Overexposure to Sulfur Dioxide may cause the following health effects:

ACUTE: This gas is toxic and damaging to the respiratory system as well as contaminated skin and eyes. Overexposures can result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and breathing difficulty. Overexposure to this gas may be fatal. Though unlikely to occur during occupational use, ingestion of large quantities may be fatal. Contact with liquid or rapidly expanding gases may cause frostbite.

CHRONIC: Prolonged or repeated overexposures may cause respiratory problems, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell. Repeated over exposures to Sulfur Dioxide can also result in dental erosion and gum disorders.

TARGET ORGANS: Respiratory system, skin, eyes, central nervous system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO SULFUR DIOXIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Personal Protective Equipment should be worn

Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

SKIN EXPOSURE: If Sulfur Dioxide contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

Note: if frostbite has occurred after exposure to rapidly expanding gases, treatment for frostbite should be initiated after the contaminated areas has been flushed (per the instructions in the previous paragraph). In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

EYE EXPOSURE: If liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes.

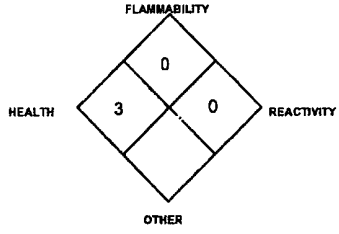
Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s). Refer to "Recommendations to Physicians," Section 11 (Toxicological Information) for additional information on first-aid measures.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

NFPA RATING



See Section 16 for Definition of Ratings

FIRE EXTINGUISHING MATERIALS: Use extinguishing media appropriate for the surrounding fire.

Water Spray: YES	Carbon Dioxide: YES	Foam: YES
Dry Chemical: YES	Halon: YES	Other: Any "ABC" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Sulfur Dioxide is a toxic gas and presents a significant health hazard to firefighters. In the event of fire, cool containers of Sulfur Dioxide with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Do not direct a water spray at the source of a release. Water spray should be used with care. Sulfur Dioxide can react with water to form a corrosive solution of sulfurous acid. Sulfurous acid can corrode metal.

Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Fight fires in a protected location. Approach fire from an upwind direction, to prevent overexposure to Sulfur Dioxide. If Sulfur Dioxide is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If unruptured cylinders are exposed to heat, the cylinder may rupture or burst and release the contents. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for firefighters to do so.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Call CHEMTREC (1-800-424-9300) for emergency assistance.

Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** A colorimetric tube is available for Sulfur Dioxide. If a colorimetric tube is used to indicate the concentration of Sulfur Dioxide, the reading obtained should be lower than the limits indicated in Section 2 (Composition and Information on Ingredients) before non-emergency personnel are permitted into area. Monitor the surrounding area for oxygen. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus (SCBA).

Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

THIS IS A TOXIC GAS. Protection of all personnel and the area must be maintained.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Sulfur Dioxide ON YOU or IN YOU. Wash hands after handling chemicals. Do not eat or drink while handling chemicals. All work practices should minimize the release of Sulfur Dioxide. Be aware of any signs of exposure as indicated in Section 2 (Composition and Information on Ingredients); exposures to fatal concentrations of Sulfur Dioxide could occur rapidly.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing the gas or sprays or mists generated by Sulfur Dioxide. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Use only compatible materials for cylinders, process lines, and other Sulfur Dioxide-handling equipment. Anhydrous Sulfur Dioxide is not corrosive to steel and other common structural materials, except zinc. In the presence of moisture, however, corrosive conditions will develop. Lead, carbon, graphite, and stainless steel, type 316 are recommended for handling moist Sulfur Dioxide. Lines should be purged with dry nitrogen both before and after maintenance activity. Keep cylinder tightly closed when not in use. Keep cylinders away from incompatible material. Wash thoroughly after using this material. Workers must be thoroughly trained to handle Sulfur Dioxide without causing overexposure. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Sulfur Dioxide emergency equipment should be available near the point of use.

- Workers who handle Sulfur Dioxide should wear protective clothing, as listed in Section 8 (Exposure Controls - Personal Protection).
- Instant-acting showers should be available in the event of an emergency.
- Special eye-wash fountains or similar equipment should be available for eye irrigation.
- Proper respiratory protection equipment must be provided and workers using such equipment must be carefully trained in its operation and limitations.
- Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, vacuum break, or trap, since suck-back may cause dangerous pressure changes within the cylinder.
- The cylinder valve should be closed after each use.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices. The rules following on the following page are applicable to situations in which cylinders are being used:

7. HANDLING and STORAGE (Continued)

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS (continued):

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "*Oxygen Deficient Atmospheres*" and CGA Pamphlet G-3, "*Sulfur Dioxide*".

TANK CAR SHIPMENTS: Tank cars carrying Sulfur Dioxide should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendations and all established on-site safety procedures. Appropriate personal protective equipment must be used during tank car operations (see Section 8, Exposure Controls - Personal Protection). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level and wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tank (for unloading) must be verified to be correct for receiving Sulfur Dioxide and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be clean and free of incompatible chemicals, prior to connection to the tank car or vessel. Valves and hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Sulfur Dioxide dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of Sulfur Dioxide and oxygen. Eye wash stations/safety showers should be near areas where Sulfur Dioxide is used or stored.

RESPIRATORY PROTECTION: Maintain Sulfur Dioxide below the exposure limits provided in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection during emergency response to a release of Sulfur Dioxide or if oxygen levels are below 19.5%. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH recommendations for Sulfur Dioxide concentrations in air are in place.

CONCENTRATION	RESPIRATORY EQUIPMENT
Up to 20 ppm:	Chemical cartridge respirator with cartridge(s); or Supplied Air Respirator (SAR).
Up to 50 ppm:	Powered air-purifying respirator with cartridge(s); or SAR operated in continuous-flow mode.
Up to 100 ppm:	Full-Facepiece chemical cartridge respirator with cartridge(s); or gas mask with canister; or powered air-purifying respirator with a tight-fitting facepiece and cartridge(s); 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.
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:	Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

The IDLH concentration for Sulfur Dioxide is 100 ppm.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of Liquid Sulfur Dioxide. Additionally, face-shields should be worn if there is a potential for contact with liquid Sulfur Dioxide.

HAND PROTECTION: Wear mechanically-resistant gloves when handling cylinders of Sulfur Dioxide. Wear chemically-resistant gloves when using this gas. Butyl rubber, chlorinated polyethylene, neoprene are recommended.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

BODY PROTECTION: Use body protection appropriate for task. Coveralls may be appropriate if splashes from the liquefied gas are anticipated. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 2.668 kg/m^3 (0.1665 lb/ft^3)
SPECIFIC GRAVITY (air = 1): 2.263
SOLUBILITY IN WATER: Converts to soluble sulfurous acid.
VAPOR PRESSURE (psia): 49.1
ODOR THRESHOLD: 3-5 ppm.
pH: Not applicable. (1% solution in water will have a pH < 3).
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

EVAPORATION RATE (nBuAc = 1): Not applicable.
FREEZING POINT: -75.5°C (-103.9°F)
BOILING POINT @ 1 atm: -10°C (14.0°F)
EXPANSION RATIO: Not available.
SPECIFIC VOLUME (ft^3/lb): 5.9

APPEARANCE AND COLOR: Colorless gas. The liquid is also colorless. The odor for both the liquid and gas is similar to that of burning sulfur.

HOW TO DETECT THIS SUBSTANCE (warning properties): Though the odor is extremely disagreeable, it does not serve as a reliable warning property for Sulfur Dioxide. The Odor Threshold is the same order of magnitude as the concentration of exposure associated with adverse health effects. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. Additionally, leaks of Sulfur Dioxide in lines or equipment may be located by passing a squeeze bottle of aqueous ammonia over sites of suspected leaks; dense, white fumes sill be formed near the leaks.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Will react with water or, moist air to form sulfurous acid.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Sulfur Dioxide is not compatible with the following materials: strong bases, strong oxidizers, powdered metals, metal oxides, sodium hydride, silver azide, cesium azide, zinc, zinc compounds, metal acetylides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with moisture and incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for Sulfur Dioxide.

Eye, rabbit = 6 ppm/4 hours/32 days; mild effects
Mutation In Microorganisms System Test = 10 mmol/L
DNA damage System Test (human, lymphocyte) = 5700 ppb
TCLo (inhalation, mouse) = 32 ppm/ 24 hours (female 7-28 day post); reproductive effects.
TCLo (inhalation, mouse) = 25 ppm/7 hours (female 6-15 days post); teratogenic effects
TCLo (inhalation, mouse) = 500 ppm/5 minutes/30 weeks; equivocal tumorigenic data
LCLo (inhalation, human) = 1000 ppm/10 minutes; pulmonary effects
TCLo (inhalation, human) = 3 ppm/5 days; pulmonary effected
TCLo (inhalation, human) = 12 ppm/1 hour; pulmonary effects
LCLo (inhalation, human) = 3000 ppm/5 minutes
LC_{50} (inhalation, rat) = 2520 ppm/1 hour
LC_{50} (inhalation, mouse) = 3000 ppm/30 minutes
LCLo (Inhalation, guinea pig) = 1039 ppm/24 hours
LCLo (inhalation, frog) = 1 pph/ 15 minutes
LCLo (Inhalation, mammal) = 3,000 ppm/5 minutes
TCLo (inhalation, rat) = 4,910 mg/m^3/6 hours/17 weeks–intermittent
TCLo (inhalation, rat) = 500 mg/m^3/96 days– intermittent
TCLo (Inhalation, dog) = 1 ppm/90 minutes/1 year– intermittent
TCLo (Inhalation, dog) = 500 ppm/2 hours/21 weeks– intermittent
TCLo (inhalation, rabbit) = 200 mg/m^3/3 hours/13 weeks– intermittent

EYE IRRITATION: Temporary clouding of eyes was seen in rabbits, guinea pigs, and mice exposed to 400 ppm for 4 hours. Very severe eye injury in rabbits was produced by a 5-second exposure to a stream of pure sulfur dioxide.

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

SHORT-TERM INHALATION STUDIES: Most studies indicate that high concentrations of Sulfur Dioxide effect the mechanics of respiration. A dose-related narrowing of the bronchiole tubes leading to bronchio-constriction was seen in guinea pigs exposed to concentrations of 0,2-100 ppm for 1 hour. Exposure of male mice for up to 72 hours to concentrations around 10 ppm produced nasal cavity injury (runny nose, ciliary loss, fluid accumulation, and tissue death). The effects became more severe as exposure time increased. Less severe effects were seen in the trachea and lungs. Other studies have not been reported any effects after 1-2 hour exposures to less than 1 ppm.

LONG-TERM INHALATION STUDIES: Exposure to 5 ppm for 225 days produced pulmonary function changes in dogs. Increased swelling, secretions, and reddening of the trachea, as well as decreased mucosal flow was seen in dogs intermittently exposed to 1 ppm for 12 months. There was no apparent effect on pulmonary function. No adverse effects were seen in guinea pigs exposed for 22 hours day, 7 days a week, for 52 weeks to concentrations of 0.13-5.72 ppm. No adverse effects were seen in monkeys exposed for 78 weeks to 0.14 - 1.28 ppm.

SUSPECTED CANCER AGENT: Sulfur Dioxide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA; therefore it is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Sulfur Dioxide is severely irritating to the eyes and may be irritating to the skin.

SENSITIZATION TO THE PRODUCT: Sulfur Dioxide is not known to cause sensitization in humans. One study involving guinea pigs exposed to 4.3 ppm Sulfur Dioxide, 8 hours/day for 5 days enhanced an allergic reaction to ovalbumin (a known allergen).

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Sulfur Dioxide on the human reproductive system.

Mutagenicity: In terms of clinical studies in animals, the following information was obtained: Sulfur Dioxide and its aqueous forms gave both positive and negative results in bacterial test. Sulfur Dioxide did not induce sister chromatid exchange, chromosomal aberrations, or micronucleus formation in the bone marrow of mice or Chinese Hamsters in in-vivo test. However, it induced morphological transformation of Syrian hamster embryo cells. Other mutagenic data are available as follows:

oms-esc = 2 mmol/L
mmo-omi = 10 mmol/L (S9)
sln-dmg-oral = 200 mmol/L
mmo-smc = 5 mmol/L (S9)
dnd- human: lymphocytes = 5,700 ppb
dni- human: lymphocytes = 5,700 ppb
oms-human: lymphocytes = 5,700 ppb
oms-ctl: other = 2,500 mmol/L
cytogenic-dom: other = 5 mmol/L
cytogenic-ctl: other = 2,500 mmol/L

Embryotoxicity: Sulfur Dioxide is not reported to cause embryotoxic effects in humans. Refer to the following paragraph for additional information.

Teratogenicity: No teratogenicity effects on humans have been described for Sulfur Dioxide. In terms of clinical studies in animals, the following information was obtained: Slight signs of fetotoxicity were seen in mice exposed to 32, 65, 125, or 250 ppm. Slight embryotoxicity was also seen when pregnant rabbits were exposed to 70 ppm during 6-15 days of pregnancy. Slight maternal toxicity was observed in both mice and rabbits. Additional teratogenic data are available as follows:

TCLo (inhalation, rat) = 4 mg/m^3/24 hours (72-days preg)
TCLo (inhalation, rat) = 4 mg/m^3/24 hours (72-days preg)
TCLo (inhalation, rat) = 4,970 mg/m^3/12 hours (12-weeks preg)
TCLo (inhalation, rat) = 30 ppm/6 hours (21-weeks male)
TCLo (inhalation, mouse) = 25 ppm/7 hours (6-15-days preg)
TCLo (inhalation, mouse) = 25 ppm/7 hours (6–15-days preg)
TCLo (inhalation, mouse) = 32 ppm/24 hours (7–18-days preg)
TCLo (inhalation, rabbit) = 70 ppm/7 hours (6–18-days preg)

Reproductive Toxicity: No reproductive toxicity effects on humans have been described for Sulfur Dioxide.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Sulfur Dioxide. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, treat symptoms, and reduce overexposure. Oxygen administration is most effective if expiration is made against a positive pressure of 4 cm. In cases of severe overexposure, the victim should breath 100% oxygen under positive pressure exhalation pressure for 1.2 hour every hour for 3 hours. Be observant for the initial stages of pulmonary edema or pneumonitis. In some cases, respiratory and circulatory stimulants (coramine, metrazol, and caffeine-sodium benzoate) may be of value.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Sulfur Dioxide.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas. Sulfur Dioxide is extremely stable to heat [up to 200°C (392°F)]. Complex reactions of Sulfur Dioxide occur in the atmosphere, producing sulfates and other sulfur compounds which contribute to air pollution.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments, respiratory system damage, and damage to the skin and eyes. Because Sulfur Dioxide produces corrosive sulfurous acid upon contact with moisture, plants may be damaged or destroyed. Frost may also be produced, in the presence of rapidly-expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Sulfur Dioxide hydrolyzes to sulfurous acid solution when in contact with water. Sulfurous acid is very soluble in water, and even low concentrations of Sulfur Dioxide or sulfurous acid in water is detrimental to aquatic life. If a release of Sulfur Dioxide occurs near a river or other body of water, the release has the potential to kill fish and other aquatic life. Additional aquatic toxicity data are available for Sulfur Dioxide, as follows:

Concentration (ppm)	Exposure (hours)	Species	Effect	Test Environment
16		sunfish	lethal	
16-19	1	sunfish	lethal	
10	0.17	trout	toxic	tap water
5		trout	lethal	
0.5	1	fish	toxic	as HSO_3
1	2	tench	lethal	as HSO_3

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to MESA Specialty Gases & Equipment. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Sulfur dioxide, liquefied
HAZARD CLASS NUMBER and DESCRIPTION:	2.3 (Poison Gas)
UN IDENTIFICATION NUMBER:	UN 1079
PACKING GROUP:	Not Applicable
DOT LABEL(S) REQUIRED:	Poison Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 125
SPECIAL PROVISION: Sulfur Dioxide is poisonous by inhalation. Shipments must be properly described as inhalation hazards. ZONE C.
MARINE POLLUTANT: Sulfur Dioxide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

SPECIAL PROVISION for CANADA: 102 (Poison-Inhalation Hazard). Emergency Response Assistance Planning requirements must be met for shipments in excess of 3,000 kg or liters.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Sulfur Dioxide is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Sulfur Dioxide	YES	YES	NO

15. REGULATORY INFORMATION (Continued)

U.S. SARA THRESHOLD PLANNING QUANTITY: Sulfur Dioxide = 500 lb.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Sulfur Dioxide is listed as an EHS (Extremely Hazardous Substance); RQ = 1 lb.

CANADIAN DSL/NDSL INVENTORY STATUS: Sulfur Dioxide is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Sulfur Dioxide is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Sulfur Dioxide (anhydrous) is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 5,000 pounds. Compliance with the OSHA Process Safety Standard (29 CFR 1910.119) may be applicable to operations involving the use of Sulfur Dioxide. Under this regulation Sulfur Dioxide (liquid) is listed in Appendix A of this Standard and the threshold quantity for Sulfur Dioxide is 1000 pounds.

U.S. STATE REGULATORY INFORMATION: Sulfur Dioxide is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Sulfur Dioxide.
California - Permissible Exposure Limits for Chemical Contaminants: Sulfur Dioxide.
Florida - Substance List: Sulfur Dioxide.
Illinois - Toxic Substance List: Sulfur Dioxide.
Kansas - Section 302/313 List: Sulfur Dioxide.
Massachusetts - Substance List: Sulfur Dioxide.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: Sulfur Dioxide.
Missouri - Employer Information/Toxic Substance List: Sulfur Dioxide.
New Jersey - Right to Know Hazardous Substance List: Sulfur Dioxide.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Sulfur Dioxide.
Rhode Island - Hazardous Substance List: Sulfur Dioxide.
Texas - Hazardous Substance List: Sulfur Dioxide.
West Virginia - Hazardous Substance List: Sulfur Dioxide.
Wisconsin - Toxic and Hazardous Substances: Sulfur Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Sulfur Dioxide is not on the California Proposition 65 lists.

LABELING:

DANGER: CORROSIVE LIQUID AND GAS UNDER PRESSURE.
CAN CAUSE EYE, SKIN, AND RESPIRATORY TRACT BURNS.

Avoid breathing gas.
Store and use with adequate ventilation.
Do not get in eyes, on skin or clothing.
Use only with equipment of compatible material and construction.
Cylinder temperature should not exceed 52°C (125°F).
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

NOTE: Suck-back into cylinder may cause rupture.
Always use a back flow preventative device in piping.

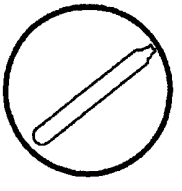
FIRST-AID: **IF INHALED**, remove to fresh air. If not breathing, give artificial respiration. (Rescuer may receive chemical burns as a result of giving mouth to mouth). If breathing is difficult, give oxygen. Call a physician. Keep under medical observation.

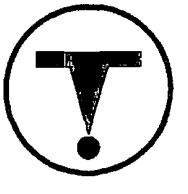
IN CASE OF CONTACT, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. (Discard contaminated shoes).

DO NOT REMOVE THIS PRODUCT LABEL.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas
Class D1A: Toxic Material/Immediate and Serious Effects
Class D2A: Other Toxic Effects/Very Toxic





16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA SPECIALTY GASES & EQUIPMENT assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA SPECIALTY GASES & EQUIPMENT assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:
ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.
OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.
IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration **(OSHA)**. NIOSH issues exposure guidelines called Recommended Exposure Levels **(RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:
HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard. **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).
NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:
Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:
Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo, LDLo**, and **LDo**, or **TC, TCo, LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

REGULATORY INFORMATION:
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act **(SARA)**; the Canadian Domestic/Non-Domestic Substances List **(DSL/NDSL)**; the U.S. Toxic Substance Control Act **(TSCA)**; Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act **(CERCLA or Superfund)**; and various state regulations.

Rosa Unit #108
API: 30-039-23506
G-S7-T31N-R06W
36.91589, -107.40081

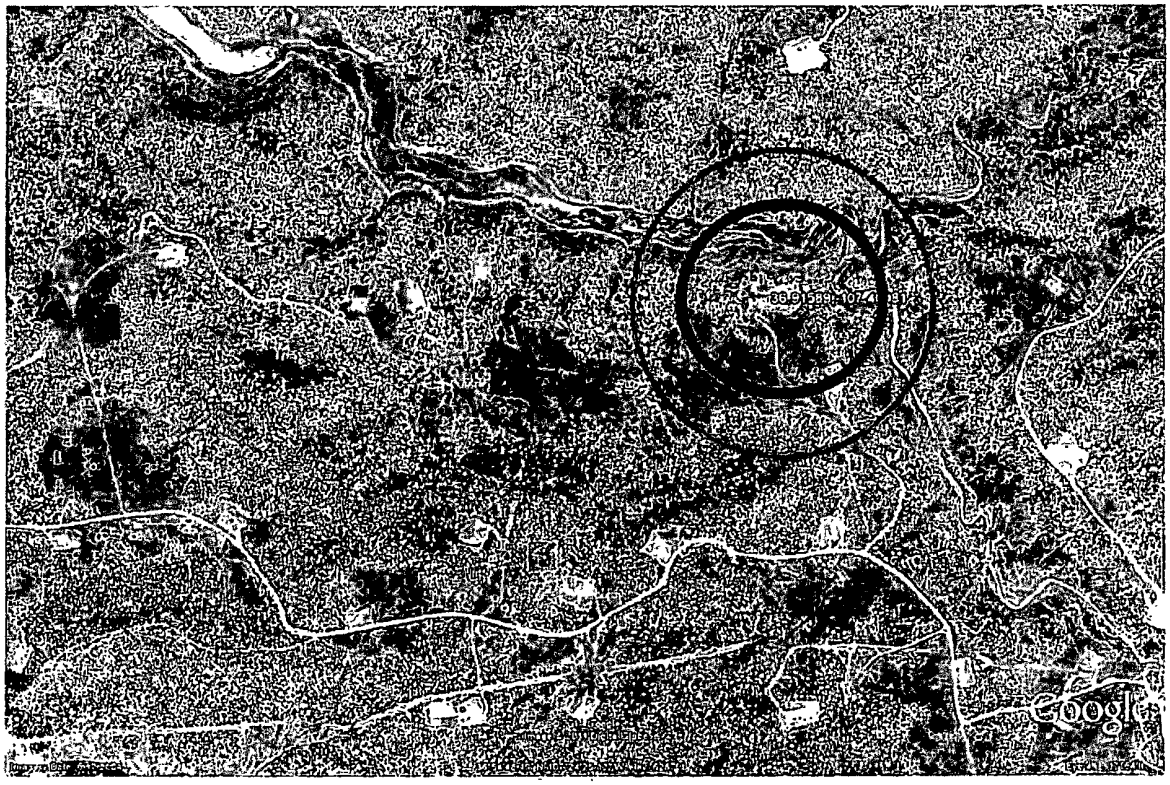
H2S Site Detail

Exposure Radius:

Based on H2S measurements taken by McGuire Consulting on Sep 29, 2011. Conservative estimates for the Radius of Exposure are as follows:

Wellsite	EXP Radius	Factor	H2S ppm	H2S	Q (cf/d)	Distance (ft)
Rosa 108	100ppm	1.589	1450	14.50%	500000	1470
Rosa 108	500ppm	0.4546	1450	14.50%	500000	672

Public Areas Affected: None
Public Roads Affected: None



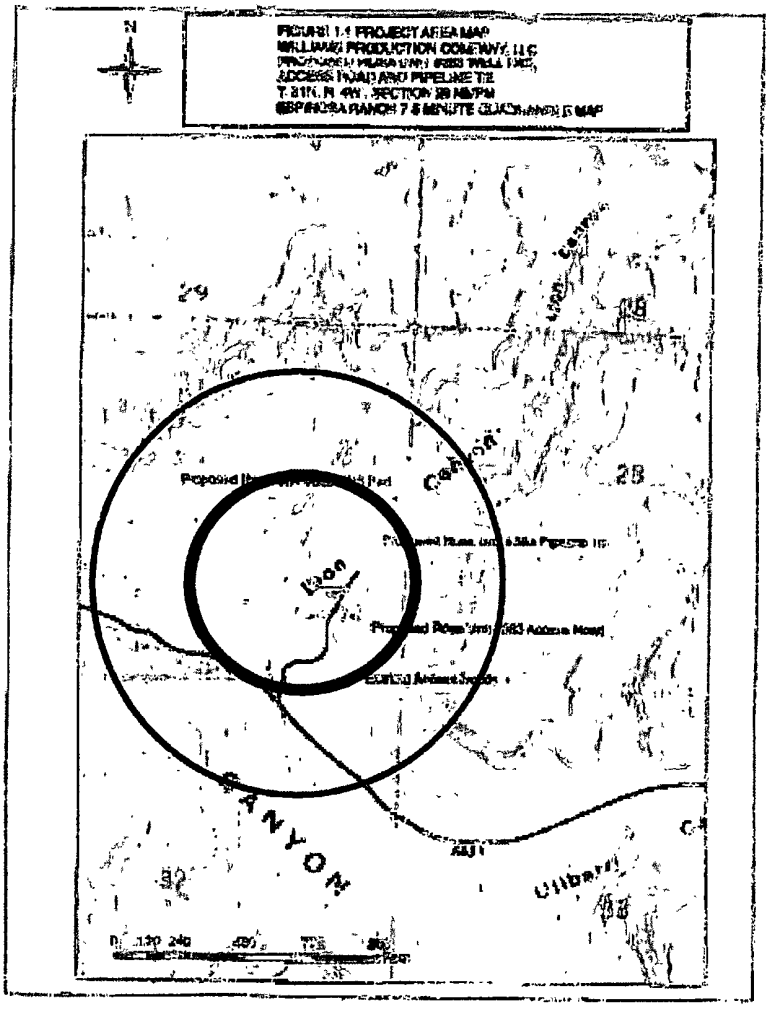
Rosa Unit #383
API: 30-039-29367
P-S29-T31N-R04W
36.86664, -107.27622
H2S Site Detail

Exposure Radius:

Based on H2S measurements taken by McGuire Consulting on Sep 29, 2011. Conservative estimates for the Radius of Exposure are as follows:

Wellsite	EXP Radius	Factor	H2S ppm	H2S	Q (cf/d)	Distance (ft)
Rosa 383	100ppm	1.589	400	4.00%	1000000	1014
Rosa 383	500ppm	0.4546	400	4.00%	1000000	463

Public Areas Affected: None
Public Roads Affected: None



McGUIRE INDUSTRIES. INC.
4403 Lomas – Farmington NM 87401
www.mcguireindustries.com
505.325.6232

DAILY SAFETY PROCEDURES

1. McGuire Safety Supervisor will arrive on Location 30 minutes prior to crew showing up. Fill out proper paperwork, JSA's sign in roster. Set up entrance signs and caution flags. H2S equipment will stay out until job is completed.
2. McGuire will enter the location on air (SCBA) each morning before work begins to sniff the area and call it safe for work to begin
3. Mask up and monitor air quality on entire location, log any and all hazard gases, set up safety equipment, briefing sign's, SCBA's, work units, escape packs in proper locations.
4. Wait for crew to arrive, check current cards as needed to enter location.
5. Sign in all personnel and do head count
6. Inform all personnel of any hazard gas reading prior to going to work.
7. Hold tailgate meeting, do head count.
8. If it is safe to enter location have crew start blowing down well. If any and all hazard gases rise move all personnel to briefing area. McGuire safety hand will mask up, if needed and continue monitoring air quality until safe to go to work.
9. Hourly H2S monitor reading and logging to capture trends
10. If hazard gases increase shut down operation and move personnel to briefing area, do head count, call proper personnel for orders.
11. Area fixed monitors audible and visual alarms
12. 10 ppm stop work order
13. Escape only breathing equipment for workers
14. Rescue SCBA for the McGuire employee to affect a rescue
15. Wind socks
16. Personnel H2S monitors for all workers
17. Daily H2S specific safety meeting and JHA
18. Written H2S site safety plan
19. McGuire will call in H2S increases to Williams and AWS of 2 ppm or more any logging period
20. All personnel on location will leave location before McGuire safety supervisor. With good communication, and work ethics it is our goal for everyone to go home safe.