

<b>Safety Policy &amp; Procedure Manual</b>		Section:	Date: 12-8-2015
		Revision:	
Subject: <b>Hydrogen Sulfide – H2S</b>			

## Hydrogen Sulfide – H2S

### Purpose

The purpose of this program is to establish minimum requirements for site specific H2S safety, which will enhance safety in the occupational setting where hydrogen sulfide is present or is recognized as being potentially present.

### Scope

This program sets forth accepted practices for Hydrogen Sulfide (H2S). This program applies to all employees of LTR, temporary employees, and any contractors working for LTR. When work is performed on a non-owned or operated site, the operator's program shall take precedence, however, this document covers LTR employees and contractors and shall be used on owned premises, or when an operator's program doesn't exist or is less stringent.

### Definitions

- Contingency Plan - a site-specific written document that provides an organized plan for alerting and protecting the public within an area of exposure following the accidental release of all potentially hazardous atmospheric concentrations of hydrogen sulfide.
- Exposure Level - permissible exposure level of hydrogen sulfide is 10 PPM for an 8-hour, time weighted average.
- Gas Detector Instrument - An instrument/detector to measure levels of H2S. Instruments may be electronically or manually operated.
- Hydrogen Sulfide (H2S) - is an extremely deadly, toxic gas that in its pure state is colorless and is heavier than air. Additionally:
  - It is the second most toxic gas known to man, ranking behind hydrogen cyanide and ahead of carbon monoxide.
  - It has the odor of rotten eggs at low concentrations.
  - In higher concentrations rapidly paralyze the olfactory nerves (sense of smell).
  - Is soluble in water and is flammable and poses a definite threat of explosion.
- Parts Per Million (PPM) - parts of vapor or gas per million parts of contaminated air by volume.

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- Personal H<sub>2</sub>S Monitor - An electronic instrument worn on the person that is set to alarm at 10 PPM of H<sub>2</sub>S.
- Possible Locations of H<sub>2</sub>S – H<sub>2</sub>S can be located in drilling operations, recycled drilling mud, water from sour crude wells, blowouts, tank gauging, during routine field maintenance involving hydrocarbons, tank batteries and wells.
- Venting - the process of discharging a material to the atmosphere through a series piping and/or venting devices, to facilitate the proper and safe dispersion of toxic materials and to minimize personnel exposure.

## Key Responsibilities

### Managers and Supervisors

- Shall ensure all employees who are to be assigned to work at locations where hydrogen sulfide is known to be present, or suspected to be present in any concentration, have been trained in hydrogen sulfide safety.
- To ensure employees have been medically approved to wear respirators and trained on the safe use of respirators, including a respirator fit test in accordance with LTR's Respiratory Protection Program.
- To ensure employees have been trained and familiar with personal H<sub>2</sub>S monitors and gas detection instruments.
- To have been provided with the client's safety procedures.
- To ensure the necessary respiratory equipment to perform the work safely is available.
- That each employee has been provided with a copy of this program.

### Employees

- Employees are responsible to comply with this program.

### Physical Effects of Hydrogen Sulfide

- H<sub>2</sub>S paralyzes the sense of smell. Do Not Rely On Smell To Detect H<sub>2</sub>s – Rely Strictly On Instruments Designed To Measure Concentrations Of H<sub>2</sub>S.
- Hydrogen sulfide is a very dangerous and deadly gas - it is colorless and heavier than air.
- It can accumulate in low places and in small concentrations it has a strong, pungent, somewhat distasteful odor similar to rotten eggs. In higher concentrations, it can deaden the sense of smell (olfactory nerve).
- Exposure to certain concentrations of H<sub>2</sub>S can cause serious injury or death.

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## Toxic Effects of Hydrogen Sulfide

CONCENTRATION	PHYSICAL EFFECT
.01 PPM	Can smell odor
10 PPM	Obvious and unpleasant odor. Beginning eye irritation. ANSI permissible exposure level for 8 hours (enforced by OSHA)
100 PPM	Immediately Dangerous to Life or Health (IDLH). Kills smell in 3-15 minutes; may sting eyes and throat. May cause coughing and drowsiness. Possible delayed death within 48 hours.
200 PPM	Kills smell shortly, stings eyes and throat. Respiratory irritation. Death after 1-2 hours exposure
500 PPM	Dizziness, breathing ceases in a few minutes. Need prompt rescue breathing (CPR). Self-rescue impossible because of loss of muscle control.
700 PPM	Unconscious quickly; death will result if not rescued promptly.
1000 PPM	Unconscious at once, followed by death within minutes.

## Procedure

Since most job sites in LTR's area of operation have the potential for the presence of H<sub>2</sub>S, all field employees shall be provided with personal H<sub>2</sub>S monitors to be worn at all field job sites.

### General

LTR's general policy is to immediately vacate any location when an employee's personal H<sub>2</sub>S alarms and contact their supervisor. LTR employees will not re-enter the area until cleared by owner/operator personnel.

LTR has a written confined space program per 29 CFR 1910.146 and employees should be trained under CF 1910.146(g) and LTR will be aware of owners contingency plan provisions.

Each person entering a H<sub>2</sub>S designated location, regardless of the concentration, shall wear at all times a personal H<sub>2</sub>S monitor that is set to alarm at 10 PPM. All monitors shall have an audible, visual and vibration alarm.

When work requires opening any equipment on location that has the potential of releasing concentrations of H<sub>2</sub>S at 100 PPM or higher, two or more H<sub>2</sub>S trained persons shall be present and follow these procedures prior to and during the opening of the equipment:

- Each person entering the H<sub>2</sub>S location shall don a personal H<sub>2</sub>S monitor prior to entry.
- A tailgate meeting will be held with everyone on location to discuss the work plan, the responsibilities of each person and the site specific contingency plan.

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- Each person shall have either a self-contained breathing apparatus (SCBA) or a supplied airline respirator equipped with a 5-minute escape pack, and shall be worn when opening the equipment to the surrounding atmosphere.
- At least one person (per two workers), equipped with a SCBA or a supplied airline respirator equipped with a 5-minute escape pack will act as a stand-by person and may not participate in the work being performed until the atmosphere has been tested and found to have no H<sub>2</sub>S present in quantities over 10 PPM. The stand-by person shall be stationed up wind, within 100 feet and in clear view of the workers.
- If an operator or other third party provides the stand-by person, it will be the responsibility of the LTR manager/supervisor in charge to verify that the person has been H<sub>2</sub>S, CPR, and First Aid trained, and that they have been provided the proper respiratory equipment.
  - Only LTR employees may wear LTR's respirator equipment.
  - LTR employees shall not use client or other third party equipment.
- After the equipment has been locked and tagged out (per LTR's Lockout/Tagout Program), opened and the H<sub>2</sub>S concentration has been cleared to less than 10 PPM, the stand-by person will no longer be required. Work may then be performed without respiratory equipment.

### **Safe Work Procedures**

- Maintain compliance with permit requirements of LTR and any requirements by the client.
- Verify that proper safety equipment is available, functioning properly and is utilized.
- Check and remain aware of wind conditions and direction.
- Perform a thorough check of the downwind area prior to the start of any potentially hazardous work activity.
- Check for other personnel and ignition sources.
- Ventilate work areas by venting and purging lines and vessels prior to beginning any work activities.
- Keep all non-essential personnel away from work areas.
- Immediately vacate the area when any H<sub>2</sub>S monitor sounds and do not re-enter without proper respiratory protection.

### **Equipment**

The following equipment shall be provided and used as required by this program:

- Personal H<sub>2</sub>S monitor set to alarm at permissible exposure limit of 10 PPM for OSHA 1926 requirements and 20 PPM for OSHA 1910 requirements. Fixed monitors may be present as well at the same alarm setting.

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- Portable H<sub>2</sub>S gas testing instrument, either electronic or manual pump operated, capable of testing the suspected concentrations of H<sub>2</sub>S in the system.
- Each testing instrument must be capable of testing the suspected concentrations of H<sub>2</sub>S by using the manufacturer's recommended calibrated tube or other means of measuring the concentration of gas.
- Testing instruments shall be calibrated periodically according to the manufacturer's recommendation, and at least annually.
- Calibration kits with regulator for calibrating the personal monitor.
- Calibration gas cylinder for testing the personal monitor.
- NIOSH-certified self-contained breathing apparatus (air pack) with a minimum of a 30-minute air supply or airline respirator with escape SCBA should be used.
- Full face, air supplied, positive pressure hose line respirator, with 5 minute escape pack attached.
- Respirator wearers requiring corrective eyewear will be fitted with spectacle kits according to the respirator manufacturer, at no expense to the employee.
- Respirators and their components, including all fittings of hoses, shall not be interchanged, which if done, would violate the approval rating of said respirator or related equipment.

### **Medical**

Each employee shall have completed a medical evaluation by a physician or licensed health care professional to determine the employee's ability to wear a respirator as required by the LTR Respiratory Protection Program.

Each employee will successfully complete the medical questionnaire and examination before being allowed to be fit tested with a respirator.

### **Training**

Employees required to work on H<sub>2</sub>S locations will be trained. Training shall consist of:

- Physical and chemical properties of H<sub>2</sub>S
- Sources of H<sub>2</sub>S
- Human physiology
- Signs and symptoms of H<sub>2</sub>S exposure, acute and chronic toxicity
- Symptomatology of H<sub>2</sub>S exposure
- Medical evaluation
- Work procedures
- Personal protective equipment required working around H<sub>2</sub>S
- Use of contingency plans and emergency response

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- Burning, flaring, and venting of H<sub>2</sub>S
- State and federal regulatory requirement
- H<sub>2</sub>S release dispersion models
- Rescue techniques, first aid, and post exposure evaluation
- Use, care, and calibration of personal monitors and gas detection instruments
- Respirator inspections and record keeping

Each respirator wearer will complete Respiratory Protection training and a Respirator Fit Test, after being given a medical clearance and before entering any H<sub>2</sub>S location.

Employees and other personnel visiting H<sub>2</sub>S locations who will not be involved in the work shall be briefed on the following prior to entering:

- Site-specific sources of H<sub>2</sub>S
- Health hazards of H<sub>2</sub>S
- Routes of egress
- Emergency assembly areas
- Applicable alarm signals and
- How to respond in the event of an emergency.

### **Rescue**

Each employee, when working alone in a H<sub>2</sub>S designated area, shall plan and become familiar with self-escape procedures to include being aware of wind direction and obstacles to avoid when exiting the work area.

Employees working under the buddy system shall pre-plan an emergency rescue and/or evacuation procedure prior to commencing work, and arrange for periodic communications with his/her supervisor, and document the discussion on each employee's service report.

### **Respirator Inspections**

Respirators will be inspected by the employee before each use and at least monthly.

The inspection will include the respirator face piece, hose, harness, 5minute escape pack cylinder and all other components of the air supply systems used.

Monthly inspections will be documented as per LTR's Respiratory Protection Program, and will be kept on file at the local office for review during safety audits.

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### **Monitors and Gas Detector Calibration**

Each personal H<sub>2</sub>S monitor shall be calibrated at least monthly and the results recorded on the calibration log.

Those monitors that do not require calibrating shall be bump checked with calibration gas to test alarms, monthly or prior to use if not used routinely.