



Hydrogen Sulfide (H₂S) Program for Construction

The purpose of this program is to inform interested persons, including employees, that EMA is complying with OSHA's Gases, Vapors, Fumes, Dusts, and Mists standard, Title 29 Code of Federal Regulations 1926.55 and other OSHA rules as needed to ensure that no employee is exposed to inhalation, ingestion, skin absorption, or contact with any material or substance at a concentration above those specified in the "Threshold Limit Values of Airborne Contaminants for 1970" of the American Conference of Governmental Industrial Hygienists found in Appendix A of 29 CFR 1926.55. **This program will address potential exposures to Hydrogen Sulfide.**

To achieve compliance we must first implement all feasible administrative and engineering controls. However, when such controls are not feasible, we will use protective equipment or other protective measures to keep the exposure of employees to air contaminants within the limits prescribed in Appendix A of 29 CFR 1926.55. All equipment and technical measures used to achieve compliance will first be approved for each particular use by a competent industrial hygienist or other technically qualified person.

Administrative Duties

This written safety program is for EMA construction work sites. The Project Manager is the program coordinator/manager and is responsible for its implementation. Copies of the written program may be obtained at our corporate offices.

H₂S Awareness

Sulfur and Sulfur Compounds may be present in crude oil as hydrogen sulfide (H₂S), as compounds (e.g. mercaptans, sulfides, disulfides, thiophenes, etc.), or as elemental sulfur. Each crude oil has different amounts and types of sulfur compounds, but as a rule the proportion stability, and complexity of the compounds are greater in heavier crude-oil fractions. As part of the work of EMA, our employees may be exposed to H₂S especially when working on corroded pipe repairs. Hydrogen sulfide is a primary contributor to corrosion in refinery processing units and piping. Other corrosive substances are elemental sulfur and mercaptans. Moreover, the corrosive sulfur compounds have an obnoxious odor.

Hydrogen Sulfide is a colorless gas at normal temperature and pressure with an odor similar to that of rotten eggs. However, presence of this gas may deaden the sense of smell, so odor alone cannot be used for detection. In cases of extreme low temperature and/or high pressure H₂S may be a liquid.

Definitions:

Sour gas-Natural gas that contains corrosive, sulfur-bearing compounds such as hydrogen

sulfide and mercaptans

Sweetening-Processes that either remove obnoxious sulfur compounds (primarily hydrogen sulfide, mercaptans, and thiophens) from petroleum fractions or streams, or convert them, as in the case of mercaptans, to odorless disulfides to improve odor, color and oxidation stability.

Health Effects & Background

Atmospheric and vacuum distillation are closed processes, and exposures are expected to be minimal. When sour (high-sulfur) crudes are processed, there is potential for exposure to hydrogen sulfide in the preheat exchanger and furnace, tower flash zone and overhead system, vacuum furnace and tower, and bottoms exchanger. There is little potential for exposure to crude oil unless a leak or release occurs. Where elevated operating temperatures are used when desalting sour crudes, hydrogen sulfide will be present. There is the possibility of exposure to ammonia, dry chemical demulsifiers, caustics and/or acids during this operation. Hydrogen chloride may be present in the preheat exchanger tower top zones, and overheads. Wastewater may contain water-soluble sulfides in high concentrations and other water-soluble compounds such as ammonia, Chlorides. phenol, mercaptans, etc, depending upon the crude feedstock and the treatment chemicals Safe work practices and/or the use of appropriate personal protective equipment may be needed for exposures to chemicals and other hazards such as heat and noise, and during sampling, inspection, maintenance, and turnaround.

Crude oils that contain appreciable quantities of hydrogen sulfide or other reactive sulfur compounds are called sour.” Those with less sulfur are called “sweet.” Some exceptions to this rule are West Texas crudes, which are always considered “sour” regardless of their H₂S content, and Arabian high-sulfur crudes, which are not considered “sour” because their sulfur compounds are not highly reactive.

Inhalation, ingestion, and contact with are all methods by which H₂S can affect the body. The effects may range from irritation of the eyes, nose, and throat; to temporary loss of smell. Headaches, dizziness, and upset stomach are more intense symptoms caused by higher concentrations. However, inhalation of high concentrations of H₂S may cause instant paralysis of the respiratory system causing loss of consciousness and death. In concentrations of H₂S at 1000 to 2000 ppm even a single breath may cause coma and may be fatal. Because of its extremely serious and/ or fatal potential, any employee believed to be exposed to H₂S shall immediately notify the supervisor or Project Manager.

Permissible Exposure Levels (PEL)

While not definitive, H₂S levels below 10 ppm appears to cause little short term effects. When H₂S level are unknown, respirators shall be used.

Current OSHA standards are:

20 ppm	Ceiling Level
50 ppm	Maximum allowable peak for 10 minutes with no other exposure

Current NIOSH standards are:

10 ppm	PEL averaged over 10 minute period
50 ppm	Area shall be evacuated

29 CFR 1910 1000(b)(2) which requires that an employee's exposure to any substance listed in Table Z-2 shall not exceed at any time the acceptable ceiling concentration limit, except for a time period and up to a concentration not exceeding the maximum duration and concentration allowed in the acceptable maximum peak column.

Hydrogen sulfide can be a severe acute hazard, and in reviewing the ANSI Standard Z 37.2-1966 it was noted that hydrogen sulfide is an extremely toxic and irritating gas and a significant property of the gas is its temporary paralytic effect on the olfactory nerves. High concentrations can result in severe consequences before the odor is detected. Sampling methods are currently available and should be used for measuring both the 10 minute and instantaneous levels of hydrogen sulfide in the workplace

Exposure detection, assessment, and monitoring

We conduct personal or area sampling for hydrogen sulfide to measure worker exposures. Air sampling is needed to measure worker exposures and select appropriate engineering controls and respiratory protection. Where data is collected it must be retained to support negative exposure assessments. At EMA we conduct both initial and periodic air monitoring

We will further perform air monitoring as needed to measure the effectiveness of controls and as required under our written excavation procedures. We utilize direct reading instruments and colorimetric tubes for quantification of exposures to Hydrogen Sulfide.

We also train our employees to identify the presence and signs and symptoms of exposure to hydrogen sulfide. Operations that could result in exposure to our employees include: Drilling Operations, Crude Oil Distribution, Refining, and Storage. Signs and symptoms of exposure are as follows:

Short Term Effects

0.13 ppm	Threshold of odor detection
0.77 ppm	Faint, but readily perceptible odor
4.6 ppm	Easily noticeable odor
10 ppm	Eye irritation, soreness, redness, burning
27 ppm	Strong, unpleasant, but not intolerable odor
50 ppm	Irritation & dryness of nose, throat, and airways cough, shortness of breath, pneumonia
100 ppm	Immediate irritation of eyes and respiratory tract
150 ppm	Sense of smell may be paralyzed
200 ppm	Headaches, dizziness, nausea
500 ppm	Unconsciousness and death within a few minutes may be no warning odor
1000 ppm	Immediate loss of consciousness and respiratory paralysis leading to death

NOTE Concentration levels from 10-50 ppm may be tolerable without immediate symptoms. However, the onset of eye and perhaps respiratory irritation may occur

several hours or even days after initial exposure. Most eye and respiratory diseases occur at these exposure levels because of the delayed effects.

Medical surveillance

Although we understand that medical examinations should always supplement effective gas, vapor, fume, dust, and mist monitoring and controls, and never substitute for them, we provide medical examinations for all workers who may be exposed to Hydrogen Sulfide at or above the respective PEL for greater than 30 days per year, found in 29 CFR 1926.55.

These medical examinations are provided by professional healthcare organizations and shall include all components as required under particular substance standards:

Record keeping

We know record keeping is critical to our safety and health program. Our record keeping tasks, at a minimum, include:

- Exposure monitoring data – 30 Years
- Medical surveillance data – Duration of employment plus 30 years

Training and information

We will provide our workers with regulatory training that includes requirements of the substance specific requirements. This will include health effects, background information, engineering controls, ppe, medical surveillance, communication of hazards, hygiene, and methods of compliance at a minimum.

Methods of compliance

This section contains our description of the specific means that we will employ to achieve compliance with the requirements of 29 CFR 1926.55

Exposures to Hydrogen Sulfide (H2S) can generally be controlled through the use of engineering controls, work practices, and personal protective equipment. Engineering controls are hazard controls designed into equipment and workplaces. Work practices are procedures followed by employers and workers to control hazards. The following engineering Controls, work practices, and personal protective equipment should be used when dealing with H2S.

- Ventilate spaces to mitigate accumulation of hydrogen sulfide or other gases.
- Notify the Project Manager upon detection of H2S
- If the potential for exposure exists and assessment of levels cannot be performed, assume the Permissible Exposure Limit is being exceeded, and wear a NIOSH approved supplied air respirator.
- For persons escaping or providing emergency help, a gas mask with proper acidic gas or H2S canister filters may be used.
- Should an alarm sound on an H2S detector, immediately evacuate the area, and notify your supervisor.

- When entering confined spaces, comply with 29 CFR 1910.146, Permit Required Confined Spaces. See EMA written Confined Spaces (Permit Required) Program.

First Aid/Medical Treatment

For exposures to hydrogen Sulfide follow the following guidelines. If you are not sure what to do, immediately initiate the P & J Emergency Action plan by calling 911 or contacting the posted emergency numbers located at the job site.

- Eye Exposure: If liquid H2S contacts eyes wash eyes immediately with water, lifting both lids. Contact lenses should not be worn when working with this chemical. If irritation persists seek medical attention.
- Skin Exposure: If liquid H2S contacts skin wash skin immediately with water. If clothing is penetrated, remove and flush skin with water. If irritation persists seek medical attention.
- Breathing. If a person breathes in a large amount of H2S, move the person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- Rescue Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the location of rescue equipment before the need arises

Communication of Hazards

We will post warning signs to mark the boundaries of work areas that have been identified to contain or potentially contain hydrogen sulfide. Additionally, we will inform contractors on Multi-employer job sites in accordance with our Contractor Safety Program.

Our Communication of Hazards program is supplemented by the requirements of 29 CFR 1926.59-Hazard Communication and is attached to this written program.