

## Hydrogen Sulfide (H<sub>2</sub>S) Safety Program

### Background:

Hydrogen sulfide presents a potential hazard to workers at the work site. It usually occurs as an unwanted by-product and can result in worker exposure in many different industries or occupations. To ensure protection against exposure to hydrogen sulfide, both workers and employers must be aware of its properties, how it affects the body and what to do in emergency situations. The Safety and Health Manager shall ensure that all personnel who will be working at the job site will be properly trained in Hydrogen sulfide awareness and contingency procedures.

### Occurrence of Hydrogen Sulfide:

Hydrogen sulfide exposures usually occur during the drilling for or production of natural gas, crude oil and petroleum products. Hydrogen sulfide is also produced by the putrefaction of organic matter and may accumulate in sewers, sewage treatment plants or hide storage pits in the tanning industry. Well drillers and tunnel workers, as well as miners, may be exposed when underground pockets of hydrogen sulfide are encountered.

Hydrogen sulfide may be used in the manufacture of inorganic sulfides, sulfuric acid and mercaptans.

### Characteristics of Hydrogen Sulfide:

Hydrogen sulfide (H<sub>2</sub>S) is a colorless gas with a powerful nauseating smell of rotten eggs. The odor is a poor warning property because hydrogen sulfide exposure quickly deadens the sense of smell. The gas is heavier than air and may collect in low areas such as sewers, pits, tunnels or gullies. High airborne levels of hydrogen sulfide (between 4.3 and 46.0 percent of gas by volume in the air) may catch fire if there is a source of ignition. If the gas is burned, toxic products such as sulfur dioxide will be formed. Hydrogen sulfide is incompatible with oxidizing agents, such as nitric acid and chlorine trifluoride, and may react violently or ignite spontaneously.

### Health Effects on the Body:

Hydrogen sulfide is extremely toxic. It may cause death instantaneously in high airborne concentrations. Low levels may be extremely irritating to the lungs, nose, throat and eyes.

Hydrogen sulfide can be detected by smell at levels as low as 0.13 parts hydrogen sulfide per million parts air (ppm). Odor cannot be used as a warning because the gas can deaden the sense of smell within 2 to 15 minutes in exposures of approximately 100 ppm. A single breath of hydrogen sulfide at about 1000 ppm may paralyze the respiratory system and result in coma and death. Convulsions may also occur. Prolonged exposure at about 250 ppm hydrogen sulfide may cause the lung tissue to swell and fill up with water (pulmonary edema).

This effect may occur after the exposed worker recovers from the irritant effects of the gas. Exposures of 20 to 50 ppm hydrogen sulfide for one hour may cause inflammation of the cornea and the delicate lining of the eye and eyelid (a condition called keratoconjunctivitis). Exposures

for long periods at 50 ppm may cause severe irritation of the nose, throat and lungs. Workers exposed to lower concentrations of hydrogen sulfide may develop headaches, eye disorders and chronic bronchitis.

Purpose:

The purpose of this Program is to protect public health and safety and those personnel essential to maintaining control of the well. This Program identifies the Company's uniform national requirements and minimum standards of performance expected from operators when conducting operations involving oil or gas or other work that is known or could reasonably be expected to contain hydrogen sulfide (H2S) or which results in the emission of sulfur dioxide (SO2) as a result of flaring H2S. This Program also identifies the gravity of violations, probable corrective action(s), and normal abatement periods.

Scope:

This Program is applicable to all onshore oil and gas lease when drilling, completing, testing, reworking, producing, injecting, gathering, storing, treating operations, and/or operations that are being conducted in zones which are known or could reasonably be expected to contain H<sub>2</sub>S or which, when flared, could produce SO<sub>2</sub>, in such concentrations that upon release could constitute a hazard to human life. The requirements and minimum standards of this Program do not apply when operating in zones where H<sub>2</sub>S is presently known not to be present or cannot reasonably be expected to be present in concentrations of 100 parts per million (ppm) or more in the gas stream. In the event the Company is hired to perform work for another Contractor, the Company shall be aware of the Contractor's contingency and emergency plan provisions.

Strict adherence to the Company's Confined Space Entry Program shall be observed when employees will be working inside tanks, vessels or in other situations that fall into the Confined Space Entry Program. Employees shall be trained per the requirements of CFR 1910.146(g).

Definitions:

A. Authorized officer means any employee of the Company authorized to perform the duties described in 43 CFR Groups 3000 and 3100 (3000.0-5).

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