



**Haulin' Jack Shipping Service, Inc.**

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

HISS (H<sub>2</sub>S) Training Version Date: 8/3/2023

# **Haulin' Jack Shipping Service, Inc.**

## **HYDROGEN SULFIDE SAFETY PROGRAM**

### **Purpose**

The following Hydrogen Sulfide (H<sub>2</sub>S) safety program has been established by *(Insert Company Name)* to control potential employee exposure and other hazards encountered during various operations performed at company work locations. In addition to the requirements and procedures of this program, company employees will be made aware of the host facility's contingency plans and programs for preventing exposure to Hydrogen Sulfide.

### **Application**

All company personnel whose work assignment may result in an H<sub>2</sub>S exposure at or above the action level (10 ppm), a level identified as potentially harmful to life. *(Insert Name)* is the company's designated "competent person" who has the authority and is responsible for determining, before beginning a job, whether H<sub>2</sub>S is present in the workplace and ensuring that proper safeguards are in place before employees are allowed to enter the site. They will also ensure adequate monitoring is in place, both fixed and personal as appropriate, and that adequate PPE is utilized.

### **Procedures**

Before the planned work of any project where an employee exposure to Hydrogen Sulfide has been identified, a schedule for the development and implementation of appropriate engineering and work practice controls will be developed. These plans shall be reviewed and revised as appropriate based on the most recent exposure monitoring data to reflect the project's current status.

In the event of a Hydrogen Sulfide release during the planned work, employees will immediately evacuate the area and move to a pre-designated site upwind from the leak source.

### **Identification**

Hydrogen Sulfide is a colorless, flammable, extremely hazardous gas with a "rotten egg" smell. It occurs naturally in crude petroleum and natural gas and can be produced by breaking down organic matter and human/animal wastes (e.g., sewage). It is heavier than air and can collect in low-lying and enclosed, poorly ventilated areas such as basements, utility holes, sewer lines, and underground telephone/electrical vaults.

In low concentrations, H<sub>2</sub>S can sometimes be detectable by its characteristic odor; however, the smell cannot be relied upon to forewarn dangerous concentrations (greater than 100ppm) of the gas because it rapidly paralyzes the sense of smell due to paralysis of the olfactory nerve. More prolonged exposure to the lower concentrations has a similar desensitizing effect on the sense of smell.

## **Training**

Employees will receive training on the risks associated with Hydrogen Sulfide exposures, the risk control methods employed by the company, and their participation in the medical surveillance program if applicable and reporting procedures for releases and any symptoms associated with an H<sub>2</sub>S exposure. This training will be provided before the employees begin work in any area where a potential H<sub>2</sub>S exposure may exist, and changes in the company operations may alter this potential exposure. If exposures are above the action level, employees shall be provided with information and training at least annually after that.

All employees who work in operations where they may be exposed to Hydrogen Sulfide gas will attend and complete a Hydrogen Sulfide Awareness Course as recommended by ANSI/ASSE Z390.1-2006. This course is required to be renewed on an annual basis. These certifications will be copied and kept in the certified employees' personnel file.

Training for non-routine job tasks regarding Hydrogen Sulfide gas exposure shall be performed on an individual job-by-job basis to address specific elements of each job.

Any employee under supplied-air shall have proper training, equipment, and medical clearance before assignment.

As previously stated, employees will be trained on the risks associated with H<sub>2</sub>S exposures. The following are topics that will be covered in this training:

- Identification of the characteristics, sources, and hazards of Hydrogen Sulfide.
- Recognition of and proper response to Hydrogen Sulfide warnings at the workplace.
- Worker awareness and understanding of workplace practices and maintenance procedures to protect personnel from exposure to Hydrogen Sulfide.
- Symptoms of Hydrogen Sulfide exposure.
- Proper use and maintenance of personal protective equipment. Demonstrated proficiency in using PPE is required.
- Use and operation of all Hydrogen Sulfide monitoring systems.
- Locations and use of safety equipment.
- Emergency response procedures, corrective action, and shutdown procedures.
- Proper rescue techniques and first-aid procedures to be used in an H<sub>2</sub>S exposure.\*
- Wind direction awareness and routes of egress.
- Locations of safe briefing areas.
- Proper use of the Hydrogen Sulfide detection methods used on the site.\*
- Confined space and enclosed facility entry procedures.
- Effects of Hydrogen Sulfide on the components of the Hydrogen Sulfide handling system.

## **Properties & Characteristics**

Listed below are the properties and characteristics of Hydrogen Sulfide:

- H<sub>2</sub>S is colorless; you cannot see it. Occasionally, it hovers over the ground on cool mornings and appears to be a fog or mist. Always remember that it has no color; it is clear.
- To most people, Hydrogen Sulfide smells like rotten eggs. In small quantities, it has a very offensive odor. In more significant concentrations, it has no odor. This is due to the paralyzing effect H<sub>2</sub>S has on the olfactory nerve and the sense of smell. This loss of the sense of smell is only temporary and will return as soon as a flow of clean air is established over the olfactory nerve.
- H<sub>2</sub>S is flammable. It has a Lower Explosive Limit (LEL) of 4.3% (43,000 PPM) and an Upper Explosive Limit (UEL) of 46% (460,000PPM). The auto-ignition temperature of Hydrogen Sulfide is approximately 518°F. H<sub>2</sub>S will explode when it ignites. Although it is highly explosive, it is a poor fuel source. Primarily, methane is mixed with H<sub>2</sub>S to ensure efficient burning. Burning H<sub>2</sub>S is another toxic gas known as Sulfur Dioxide or SO<sub>2</sub>.
  - Sulfur Dioxide is also a colorless gas. It smells like a burned kitchen match. Like H<sub>2</sub>S, it is very offensive to the respiratory system and eyes. It is also possible that you may feel SO<sub>2</sub> on your skin, especially if your skin is wet. It is classified as an acid gas and can cause chemical pneumonia and scarring of the lungs.
  - Sulfur Dioxide is a heavier-than-air gas. Its vapor density is 2.212, almost twice as heavy as H<sub>2</sub>S.
  - SO<sub>2</sub> is not flammable. It will not burn because it is a by-product of the incomplete combustion of Hydrogen Sulfide.
- Hydrogen Sulfide has a vapor density of 1.189 and is heavier than air (1.0). It will settle in low-lying areas and travel just like water. It will eventually fill up these lower areas and displace the oxygen, or it will flow back to a source of ignition and cause fire or explosion. It is essential to stay out of low-lying areas and stay on high ground.
- H<sub>2</sub>S is soluble in water and liquid hydrocarbons, will mix with most liquids, and free itself at ambient temperatures. Hydrogen Sulfide must be compressed or cooled to remain a liquid.
- H<sub>2</sub>S is readily dispersed by wind. The ambient air will dilute the Hydrogen Sulfide. Always stay upwind from the source during any H<sub>2</sub>S emergency.
- Hydrogen Sulfide is highly corrosive to metals. It causes steel to become brittle with resulting failure under minimum stress. The more complicated the material, the quicker H<sub>2</sub>S affects it.

## HEALTH EFFECTS

The principal hazard of H<sub>2</sub>S exposure is death by inhalation. It is highly toxic. It will suffocate by attaching itself to the red blood cells in your bloodstream and prevent them from carrying oxygen to the tissues and organs of the body. During exposure, as the gas builds up

in your bloodstream, you will find yourself breathing faster and faster. The faster you breathe, the more H<sub>2</sub>S enters your lungs. Soon the respiratory control center of the brain will become paralyzed and stop functioning. Depending on the concentration, this can happen in less than 3 minutes.

- Alcohol consumption within 24 hours can cause this process to be quicker than average. This is due to the body's oxidation process to rid itself of alcohol. Unfortunately, this process leaves no excess reserve for the body to fight off the effects of H<sub>2</sub>S. Do not consume alcohol within 24 hours of being exposed to H<sub>2</sub>S.

When Hydrogen Sulfide is released in lower levels, employees may observe the following symptoms as the exposure time increases:

- Slight 'rotten egg' smell
- Eye irritation
- Skin irritation
- Fatigue
- Nausea
- Dizziness
- Headache
- Coughing
- Dryness in the nose and throat
- Irrational behavior
- Loss of consciousness
- Termination of life processes

\*The above symptoms take hours to inform or run their course in minutes if the concentration is extreme.

## TOXICITY

Numbers are in Parts Per Million (PPM)

- 0.13 PPM** - Minimal perceptible odor (can first be detected by smell).
- 4.6 PPM** - Easily detectable, moderate odor.
- 10 PPM** - Beginning of eye irritation. \*\*Level not to be exceeded at any time without respiratory protection.
- 10-50 PPM** - Strong, unpleasant odor; not tolerable. Marked eyes, nose, throat, and lung irritation.
- 50-100 PPM** - Most individuals lose a sense of smell due to the effect of the gas on the olfactory nerves in the nose. Intense eyes, nose, throat, and lung irritation.
- 100 PPM** - Immediately Dangerous to Life and Health (IDLH).
- 200-300 PPM** - Marked conjunctivitis (eye inflammation), respiratory tract irritation after one hour.
- 100-500 PPM** - Loss of consciousness, poor balance, and confusion. Lungs may fill with fluids (pulmonary edema).
- 500-700 PPM** - Possible death in 30 minutes to 1 hour.

**700-1,000 PPM** - Rapid unconsciousness, cessation (stopping or pausing) of respiration. Permanent brain damage or death may occur if not rescued and renewed immediately.

**1,000-2,000 PPM** - Unconsciousness at once, with early cessation of respiration and death in a few minutes (usually 3 minutes or less). Death may occur even if the individual is rescued and removed to fresh air at once.

PPM = Parts of gas per million parts of air by volume - 1%= 10,000 PPM

### **How small of an amount is 1 PPM of gas?**

If one inch represented one PPM of gas, it would be equivalent to 1 inch in 15 ½ miles in the distance.

If one second represented one PPM of gas, it would be equivalent to one second in 11 ½ days.

# TOXICITY OF VARIOUS GASES

Common Name    Chemical    Vapor

TLVLC

|                |                 |         |  |
|----------------|-----------------|---------|--|
| Carbon Dioxide | CO <sub>2</sub> | 1.52    |  |
|                | Formula         | Density |  |

5000 PPM    10%

Sulfur Dioxide    SO<sub>2</sub>    2.21    2 PPM  
0.01%

Hydrogen Sulfide    H<sub>2</sub>S    1.189    10  
PPM    600PPM

Methane    CH<sub>4</sub>    0.55    9%

Hydrogen Cyanide HCN    0.94    10  
PPM    300PPM

Carbon Monoxide CO    0.97    50  
PPM    0.01%

## **Sour Sites**

### **Identification of Sour Sites**

All sources and concentrations of H<sub>2</sub>S will be identified before entry to the worksite. All areas where concentrations exceed 10 PPM will be posted at the location entrance showing the poisonous gas symbol (Appendix). A sign stating the legal description of the surface location, name, and telephone number of the licensee or operator will also be posted. All worksites where H<sub>2</sub>S exists will have a form of wind direction indicator.

### **Entry to Sour Work Sites**

Before any person enters the immediate area where H<sub>2</sub>S is present at or above 10 PPM, all of the following conditions will be satisfied:

1. The atmosphere in and around all buildings and equipment located on a worksite will be controlled within the occupational exposure limits;
2. All employees who work in operations where they may come in contact with Hydrogen Sulfide gas above the occupational exposure limits should be equipped with a personal Hydrogen Sulfide gas detector that is capable of alarming at 10 PPM unless continuous atmospheric monitoring is conducted or checked according to a site-specific procedure;
3. Continuous monitoring equipment is present in all buildings to be accessed, or it has been checked according to a site-specific procedure;
4. Any duties other than routine shall be according to a site-specific procedure;
5. Communication monitoring, entry, and work procedures are in place. A complete risk assessment is to be performed to determine if respiratory protection and emergency backup procedures are in place. Any employee under supplied-air shall have proper training, equipment, and medical clearance before assignment.
6. Should this work assignment meet the definition of a confined space, then the special precautions required by our confined space program shall be strictly adhered to.
  - a. Confined spaces may include but are not limited to tanks, vessels, some bell holes, cellars, and valve vaults.



## **Before Entering Areas with Possible Hydrogen Sulfide**

Before any person enters an area where H<sub>2</sub>S may be present, all of the following conditions will be satisfied:

1. The air needs to be tested for the presence and concentration of hydrogen sulfide by a qualified person using test equipment. This individual also determines if fire/explosion precautions are necessary.
2. If gas is present, the space should be ventilated.
3. If the gas cannot be removed, use appropriate respiratory protection and necessary personal protective equipment (PPE), rescue and communication equipment. Atmospheres containing high concentrations (greater than 100 PPM) are considered immediately dangerous to life and health (IDLH), and a self-contained breathing apparatus (SCBA) is required.
4. All employees who work in operations where they may come in contact with Hydrogen Sulfide gas above the occupational exposure limits should be equipped with a personal Hydrogen Sulfide gas detector that is capable of alarming at 10 PPM unless continuous atmospheric monitoring is conducted or checked according to a site-specific procedure;
5. Should this work assignment meet the definition of a confined space, then the special precautions required by our confined space program shall be strictly adhered to.
  - a. Confined spaces may include but are not limited to tanks, vessels, some bell holes, cellars, and valve vaults.

## **Personal Protective Equipment (PPE)**

PPE will be worn, where appropriate, to control the risk of exposure of eye, skin, and lung contact to Hydrogen Sulfide. Depending on the potential exposure circumstance, the following PPE will be utilized:

In liquid form:

- Chemical protective coveralls, boots, and other chemical protective clothing should be worn if there is potential for contact with the liquid. A chemical protective full-body encapsulating suit and respiratory protection may be required in some operations.
- Chemical safety goggles to prevent eye contact with the liquid that could result in burns or tissue damage from frostbite. A face shield may also be necessary.
- Use thermally insulated gloves when working with containers of Liquid Hydrogen Sulfide.
- Properly fitted, air-purifying, or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on

known or anticipated exposure levels, the hazards of the product, and the safe working limits of the selected respirator.

- Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flashpoint <100°F).

In gaseous form:

- Use body protection appropriate for the task. Static-resistant clothing is recommended. Transferring large quantities under pressure may require fire retardant and chemically impervious clothing.
- Safety shoes are recommended when handling cylinders.
- If a half-mask respirator is used, tight-fitting goggles must also be used.
- Cotton work gloves must be worn when handling cylinders of Hydrogen Sulfide and chemically resistant gloves when around this gas. Butyl rubber, chlorinated polyethylene, neoprene nitrile, and polyvinyl rubber are recommended.

This equipment will be inspected before use and maintained in a safe working condition. If any defects are found or occur during use, this equipment will not be allowed for use and will be provided and replaced at no cost to the employee.

## **Respiratory Protection**

When the engineering and work practice exposure controls are determined by air sampling (representative 8-hour TWA employee exposures shall be determined based on one sample or samples representing the full-shift exposure for each job classification in each work area) to be ineffective in maintaining acceptable exposure levels, respiratory protection will be provided and utilized by the company's respiratory protection program.\*

For potential Hydrogen Sulfide exposures, the following NIOSH recommendations will be followed:

### **Up to 100 ppm:**

(AFP = 25) Any powered, air-purifying respirator with cartridge(s) protects the concerned compound.

(AFP = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister protecting the compound of concern.

(AFP = 10) Any supplied-air respirator, with proper eye protection.

(AFP = 50) Any self-contained breathing apparatus with a full facepiece.

### **Emergency or planned entry into unknown concentrations or IDLH conditions:**

(AFP = 10,000) Any self-contained breathing apparatus has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

(AFP = 10,000) Any supplied-air respirator with a full facepiece is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

**Escape:**

(AFP = 50) any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister protecting the compound of concern.

Any appropriate escape-type, self-contained breathing apparatus.

For any unknown or concentrations determined to be immediately dangerous to life and health (IDLH), a self-contained breathing apparatus (SCBA) with full-facepiece in positive pressure demand mode, or a full-facepiece, supplied-air respirator in positive pressure demand mode with auxiliary self-contained air supply must be used.

When employees wearing breathing apparatus are required to work inside vessels or tanks, etc., there must always be a qualified attendant or helper with rescue equipment available and ready for use. Approved safety harnesses and lifelines must be worn and, when entry is from the top, it is recommended that there be at least two helpers or attendants. Workers in H<sub>2</sub>S areas must know how to perform Artificial Respiration.

## Worker Exposure Limits

| Exposure Time | Exposure Limit | Description   |
|---------------|----------------|---|
| 8 – Hour      | Ten ppm        | Time-weighted average (TWA) for 8 hours                 |
| 15 – Minute   | 15 ppm         | TWA average for up to 15 minutes, with 60-minute breaks |
| Ceiling       | 20 ppm         | Never exceed without respiratory protection             |

## Air Monitoring

Monitoring equipment shall be made available in operations where concentrations of H<sub>2</sub>S in the ambient air could reach 10 PPM or more. All employees in these situations will have completed the required Hydrogen Sulfide Awareness Course as recommended by ANSI/ASSE Z390.1-2006 and know the selection and use of protective equipment.

The toxicity of Hydrogen Sulfide requires that monitoring equipment have a rapid response time to alarm and alert personnel of potentially dangerous concentrations. Hence, the response time of monitoring equipment is an essential criterion for selecting and evaluating such equipment.

### **Personal Detection Monitors**

As an employee of *(Insert Company Name)*, you will be issued a personal H<sub>2</sub>S detection monitor before performing any work duties at H<sub>2</sub>S sites. You are required to keep this monitor in good working condition when it is in your possession. *(Insert Company Name)* will calibrate these monitors according to the manufacturer's recommendations.

The employee will be trained on the proper maintenance and use before being given an assignment where H<sub>2</sub>S could be present.

### **Fixed Monitors**

Fixed monitors are fixed to a location and quantitative electronic devices for permanent, 24 hours per day operation. Sensor heads are placed at various locations on the site and attached to the detection, which is housed in a hard plastic or metal case. The monitor's usually read in PPM concentration and is shown on a needle-type indicator or digital readout. A rotating beacon or strobe light is attached to the unit that will automatically activate when a specified amount of gas has been detected. An audible alarm denotes a higher gas concentration level, 10-50 PPM and above.

\*\*Consult your Safety Representative to ensure these specifications coincide with your company's system.

## **Emergency Evacuation Procedures**

Owners or operators of known Hydrogen Sulfide environments should have a prepared contingency plan in place. Employers shall make every effort to obtain a copy of this plan before beginning work and use this material for a pre-job briefing or tailgate safety meeting before commencing work. This plan shall be evaluated using the Job Safety Analysis (JSA) process to determine if it offers adequate protection to all employees on the worksite.

1. **Evacuate** – Get to a safe area immediately;
  - Move upwind if release is downwind of you;
  - Move crosswind if release is upwind of you;
  - Move to higher ground if possible;
2. **Alarm** – Call for help;
3. **Assess** – Consider other hazards;
4. **Protect\*** – Put on breathing apparatus before attempting rescue;
5. **Rescue\*** – Remove victim to a safe area;
6. **Revive\*** – Apply CPR, if necessary;
7. **Medical Aid** – Arrange transport of victim to medical aid.

**It is better to let the  
facility owner  
conduct steps 4 & 5**

**\*Only perform rescue procedures if you have been adequately trained.**

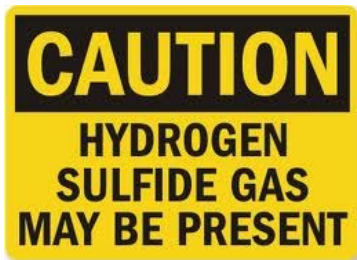
### **Hazard Communication**

Previously identified areas, those locations where the employee may potentially be exposed to Hydrogen Sulfide, will be marked with the following similar signage:

While most oilfield locations are known H<sub>2</sub>S wells, a location that is not marked does not mean H<sub>2</sub>S gas could not be present. Always follow precautions.



**Poisonous Gas Symbol**



**Haulin' Jack Shipping Service, Inc.**  
**HYDROGEN SULFIDE SAFETY PROGRAM ACKNOWLEDGEMENT**

I, \_\_\_\_\_ have received training on the risks associated with Hydrogen Sulfide exposure, the company risk control program and procedures and I have asked and received clarification on all questions regarding this risk.

\_\_\_\_\_  
Employee Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Supervisor's Signature

\_\_\_\_\_  
Date