

Hydrogen Sulfide (H₂S)

1. Purpose

The purpose of this policy is to prevent over-exposure to hydrogen sulfide.

2. Scope

This policy applies to all USPL employees and contractors who have the likelihood of being exposed to H₂S, and includes information on the hazardous levels of H₂S, requirements for working safely in these environments, and what to do in an H₂S emergency.

3. Minimum Requirements

	Minimum Requirements	Supporting Documentation
1.	Only positive-pressure self-contained breathing apparatus (SCBA) or positive-pressure air-line units with an emergency egress bottle shall be used in any known or suspected H ₂ S environment of 10 ppm or greater in the breathing zone.	Section 6
2.	When performing specific tasks where there is a significant likelihood of exposure to 10 ppm or greater H ₂ S in the breathing zone, portable or personal H ₂ S monitors shall be used.	Section 8
3.	A safety watch is required when H ₂ S concentrations exceed 100 ppm in the worker's breathing zone	Section 8
4.	Appropriate H ₂ S warning signs shall be posted in immediate areas presenting potential H ₂ S exposure.	Section 9 and Appendix II
5.	USPL employees who work in areas where high sulfide containing materials (e.g. crude oil, Bunker Fuel), are stored or handled, shall receive training and information on the hazards associated with H ₂ S, emergency procedures and this policy.	Section 10

4. Definitions

Air-line respirator—A breathing apparatus that is connected to a stationary source of breathing air by a hose. The air is delivered continuously in a sufficient volume to meet the wearer's breathing requirements. The length of the hose connection and the dangers of damage to the hose can restrict the user. USPL requires air-line respirators to be used in the positive pressure mode.

Hydrogen sulfide (H₂S)—A colorless, extremely poisonous gas that has a very disagreeable odor, much like that of rotten eggs at low concentrations, but deadens the sense of smell at higher concentrations. In dangerous concentrations, it is extremely corrosive and poisonous, causing damage to skin, eyes, breathing passages, and lungs and attacking and paralyzing the nervous system, particularly that part controlling the lungs and heart. Hydrogen sulfide is flammable; in an excess of air it burns to form sulfur dioxide (SO₂).

Immediately dangerous to life or health (IDLH) atmosphere—An atmospheric concentration of any toxic, corrosive, or asphyxiate substance that poses an immediate threat to life or would cause irreversible or

delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. The IDLH for H₂S is 100 ppm.

Permissible exposure limit (PEL) (10 ppm for H₂S)—An exposure limit that is set and enforced by OSHA. The PEL is the maximum amount or concentration of a chemical or agent that a worker may be exposed to. The PEL can be based on either a time-weighted average (8 hours), or the maximum exposure limit described by the regulation.

Safety Watch – An individual trained and qualified for rescue and retrieval to provide “stand-by service” for individuals working in IDLH atmospheres. .

Self-Contained Breathing Apparatus (SCBA)— Air supplied to a full face mask from a cylinder worn by the worker. This gives greater movement than an air-line respirator, but the air supply is limited.

5. Roles and Responsibilities

- A. Supervision at each USPL facility which handles H₂S containing material shall control worker exposures to H₂S below 10 ppm.
 - 1. Make appropriate respiratory protection available for prevention of H₂S overexposures while performing specific tasks (see PPE Matrix), and for emergency response.
 - 2. Ensuring that all employees and contractors are trained in H₂S safety *prior to working in areas* where H₂S may be present.
 - 3. Ensuring that all air-supplied respiratory equipment is inspected, maintained, cleaned, and stored correctly.
- B. Safety Coordinators are responsible for:
 - 1. Assisting in identifying areas, procedures, tasks, and other situations that can result in exposure to H₂S.
 - 2. Assisting in implementing H₂S exposure controls.
 - 3. Providing guidance during emergency exposure incidents in consultation with USPL Health Services and Industrial Hygiene.

6. H₂S Respiratory Protective Equipment

- A. Only positive-pressure self-contained breathing apparatus (SCBA) or positive-pressure air-line units with an emergency egress bottle shall be used in any known or suspected H₂S environment of 10 ppm or greater in the breathing zone. The use of canister-type air purifying respirators for protection against H₂S is prohibited in all USPL locations.

Note: See Respiratory Protection Policy for further requirements.

7. **Fixed** H₂S Detection Equipment

Facilities that transport or store crude oil, bunker fuel or heavy fuel oil should perform an evaluation to determine if fixed H₂S detection and alarm systems are needed. This evaluation should consider the likelihood of H₂S gas accumulating in high concentrations in enclosed workplaces (e.g. crude oil pump rooms, pumping/sampling stations), where workers may be unknowingly exposed. These evaluations should be conducted following consultation with USPL HSE staff and/or Industrial Hygienist.

All fixed H₂S detection/alarm systems should:

- A. Be set to activate at 10 ppm for a low alarm and at a maximum of 100 ppm for a high alarm.

- B. Have a distinctive visible and audible alarm consistent throughout the facility.
- C. Activate alarms both in the field and in the applicable control room.
- D. Be responded to according to the requirements of this policy.
- E. Be calibrated and maintained per manufacturer's specifications.

8. Working in H₂S Environments

- A. When performing specific tasks where there is a significant likelihood of exposure to 10 ppm or greater H₂S in the breathing zone, portable or personal H₂S monitors shall be used with low alarms set to ≤10 ppm and high alarms set to ≤20 ppm. See Appendix III of the Air Monitoring Policy for recommended air monitoring equipment.
- B. Air supplied respirators are required for entering, working, or performing tasks in work environments where there is a likelihood of H₂S being present in concentrations at or greater than 10 ppm in the breathing zone.

Note: The IDLH for H₂S is 100 ppm. USPL does not allow work in an actual IDLH atmosphere.

9. Requirements for Gauging Crude Oil and Bunker Fuel Tanks

9.1. Air Monitoring

- A. H₂S concentrations are to be measured at the face of the thief hatch on all crude oil, bunker fuel and heavy fuel oil tanks.
- B. Personal exposure measurements should be taken with single-gas, H₂S monitors positioned in or as close to the breathing zone as possible (i.e. breast pocket). H₂S concentration measurements for areas other than tank openings should be performed in the breathing zone.

9.2. Equipment, Personnel, and Testing Requirements

- A. When gauging or sampling Crude Oil, Bunker Fuel, or Heavy Fuel Oil tanks workers shall use an air supplied respirator in conjunction with a portable hand-held H₂S monitor to determine H₂S concentrations at the thief hatch. A personal, single gas H₂S monitor shall also be worn clipped to the hard hat, collar or in a breast pocket to measure breathing zone concentrations. Additionally, when workers gauge/sample tanks with external floating roofs, they shall assure all the requirements of the Confined Space Entry policy are met *before the tank may be gauged or sampled*. The tank mixer shall be off and no flow may be allowed into or out of the tank for at least two hours prior to entry onto tank roof. The inlet valve to the tank shall be closed.
- B. The respirator's face piece shall be donned and pressurized when opening the hatch. H₂S concentration measurements are to be taken at the hatch opening using a hand held, portable monitor equipped with an H₂S sensor and powered pump.
 - 1. If hatch measurements are **below 100 ppm, and breathing zone measurements are below 10 ppm**, the face piece can be removed and gauging and/or sampling can proceed.
 - 2. If hatch measurements are **below 100 ppm but breathing zone measurements are greater than 10 ppm** gauging and/or sampling shall proceed while wearing the respirator face piece.
 - 3. If hatch measurements are **at or greater than the IDLH of 100 ppm** the worker shall immediately stop the gauging/sampling and leave the area.

9.3. Warning Sign Requirements

- A. Consideration should be given to posting the following sign in locations where there is a potential for H₂S to be present. Examples include crude oil tank dike areas, crude manifolds, and crude booster pumping stations.

CAUTION

H₂S May Be Present

- B. The following signs shall be posted where Crude Oil or Heavy Bunker Fuel is present and there is a likelihood of airborne concentrations of 10 ppm or greater. Examples of such areas include; Crude System valve vaults, pump rooms/buildings and entry ways into Crude Oil and Heavy Bunker Fuel storage tanks:

DANGER

H₂S in Concentrations
> 10 ppm May be Present

- C. See Appendix I or the Signs and Color Coding Policy for samples of H₂S signs.

9.4. Wind Indicator Requirements for Crude Oil Storage Tank Facilities

- A. Wind indicators shall be installed at a height which is visible from all locations within a facility to give an accurate indication of wind direction.

10. Training

- A. Personnel shall complete training in H₂S safety *before working* in any area where H₂S may be present.
- B. The initial H₂S training program should include the following topics:
1. The hazards, properties, and characteristics of H₂S
 2. Sources of H₂S
 3. The use of H₂S detection devices
 4. Description of H₂S detection systems used in the workplace
 5. The signs and symptoms of H₂S exposure
 6. The use and limitations of respiratory protection equipment for H₂S
 7. Wind direction awareness and evacuation routes.
- C. All employees who work in or may be required to work in an H₂S area shall complete a refresher course in H₂S safety every 3 years.

11. References

1. American National Standards Institute, Z37.2-1972, "Acceptable Concentrations of Hydrogen Sulfide."
2. American Petroleum Institute, RP 55, "Conducting Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide," October, 1981.
3. Occupational Health and Safety Administration, Department of Labor, 29 CFR 1910.134, "Major Requirements of OSHA's Respiratory Protection Standard."
4. Occupational Health and Safety Administration, Department of Labor, 29 CFR 1910.1000(b)(2), "Toxic and Hazardous Substances, Acceptable Ceiling Concentrations."

Appendix I H₂S Signs



Danger sign used at all field locations where there is a likelihood that H₂S exposures greater than 10 ppm may be present.



Caution sign used when there is a potential for H₂S concentrations greater than 10 ppm.