

Hydrogen Sulfide Procedure

January 2023

A. Introduction

This program will be used as a guideline for minimum requirements for personal protective equipment, safety, and training in relation to local and governmental regulations as well as IPS★ITCS' personal requirements, which will meet or exceed all others.

B. Definitions

Hydrogen Sulfide - (aka H_2S) a colorless gas with a specific gravity that is heavier than air. This gas is most easily recognizable by its rotten egg odor. This gas is a desensitizer; therefore, after a short exposure you will lose your sense of smell and taste.

Sulfur Dioxide - (aka SO_2) colorless and odorless gas, which is produced by burning hydrogen sulfide. This gas is an irritant to the eyes, nose, and throat.

P.P.M - (parts per million) system for measuring the amount of a gas in the air.

PEL - (permissible exposure limit) The PEL for Hydrogen Sulfide is 10 ppm. This is an amount you can safely breathe, based on an 8-hour day.

STEL - (short term exposure limit) The STEL for hydrogen sulfide is 15 ppm. This is how much you can safely be exposed to over a 15-minute period.

I.D.L.H.- (Immediate danger to Life and Health) I.D.L.H concentrations represent the maximum concentration from which, in the event of respirator, one could escape within 30-minutes without a respirator and experience no escape-impairing or irreversible health effects (e.g., severe eye irritation).

C. Potential H_2S Containing Operations

- a. Drilling Operations
 - i. Recycled Drilling Mud
 - ii. Water from sour crude wells
- b. Tank Gauging – Tanks in producing, pipeline, and refining operations.
- c. Field Maintenance – Tank batteries and wells.
- d. Unloading certain Reactors
- e. Some catalyst purging and screening operations
- f. Operations in Refineries and Gas Plants with appropriate feed stocks

D. Permissible Exposure Limit

The P.E.L. for hydrogen sulfur is 10 ppm. Refer to OSHA 29 CFR For proper monitoring procedures. (See ***HSE.PRO.Gas Hazards Procedure.2022***)

E. Short Term Exposure Limit

The S.T.E.L. for hydrogen sulfide is 15 ppm. Refer to OSHA 29 CFR for proper monitoring procedures. (See ***HSE.PRO.Gas Hazards Procedure.2022***)

F. Physical Properties of H₂S

1. H₂S is extremely toxic and can cause death at very low concentrations
2. H₂S, also known as sour gas, is a colourless toxic, corrosive and flammable gas, which is heavier than air and tends to collect in low-lying areas such as trenches, sumps, and confined spaces.
3. H₂S reacts with the internal surfaces of carbon steel vessels in the absence of oxygen to form pyrophoric iron sulphide. Pyrophoric iron sulphide can auto-ignite when exposed to air.
4. Sulfur Dioxide - (aka SO₂) colorless and odorless gas, which is produced by burning hydrogen sulfide. This gas is an irritant to the eyes, nose and throat.
5. Water solubility: H₂S is readily dissolved in both water and hydrocarbons, dependent on temperature and pressure to be soluble, and quickly released, by simply agitating the fluid

Property	Characteristic
Color	Colorless
Odor	H ₂ S concentration, when: <100 ppm - has a distinctive, offensive smell – similar to rotten eggs >100 ppm - impairs the sense of smell; therefore, the nose cannot be relied upon to detect the presence of H ₂ S
Vapor Density	1.189 – heavier than air
Explosive limits and flammability	4.3 to 46 percent – by volume in air H ₂ S explodes over a very wide range, when: <ul style="list-style-type: none"> • mixed in the right proportions with air (oxygen), and • there is a source of ignition. Burns readily (with a distinctive blue flame) Produces Sulphur Dioxide (SO ₂) – another toxic gas
Auto Ignition Temperature	500°F (260°C)
Reactivity	Can react with carbon steel, in the absence of oxygen – forming Pyrophoric Iron Sulfide (on the internal surfaces of vessels), which in turn can react upon contact with air (oxygen) – auto igniting
Water Solubility	H ₂ S is: <ul style="list-style-type: none"> • Readily dissolved in both water and hydrocarbons • Dependent on temperature and pressure to be soluble • Quickly released, by simply agitating the fluid
Corrosives	H ₂ S forms a corrosive mixture with water
Boiling Point	<ul style="list-style-type: none"> • 140°F (60°C) at normal pressure • Liquefied H₂S boils at a very low temperature and is normally found as a gas

G. Emergency Procedures

Properly executed procedures in an emergency situation can mean the difference between life & death.

1. Monitoring:
 - a. Personal and area monitors that alarm when the PEL exceeds the preset level of 10 ppm.
 - b. When monitor alarms sound vacate the area and do not re-enter without proper respiratory protection.
2. Respiratory Protection:
 - a. NIOSH certified self-contained breathing apparatus or
 - b. Airline respirator with 5-minute escape cylinder
3. Eye Exposure:
 - a. Flush your eyes with clear running water for at least 15 minutes.
 - b. Force eyelids open if necessary.
 - c. Seek medical attention.
4. Skin Exposure:
 - a. Remove contaminated clothing.
 - b. Rinse skin thoroughly.
 - c. Wash clothes before wearing them again.
5. Spill or Leak:

Always know the location of the nearest eye wash station and the nearest safety showers. If not already done activate emergency response system. **IPS★ITCS should be aware of owner's contingency plan provisions.**

 - a. Hold your breath.
 - b. Move upwind or crosswind and away from the gas.
 - c. Put on appropriate breathing apparatus.
 - c. Assist anyone in distress and move to a predetermined assembly area.
 - e. Do not attempt to rescue victims.
 - f. Protect yourself. Don't become another victim.
6. Avoiding Exposure- know the location of the following:
 - a. Emergency exits.
 - b. Emergency phone numbers.
 - c. Safe assembly areas.
 - d. Windssocks, streamers, or flags to determine direction.

- e. Emergency SCBA.
- 7. Remain wind conscious:
 - a. Pay attention to windsocks, streamers, or flags.
 - b. Make sure proper ventilation of buildings is in use.
 - c. Turn off air-conditioning units, which could further expose personnel.
 - d. Know how to use air-monitoring devices.
 - e. Do not smoke.
 - f. Shut down all hot work in the area.
 - g. Be aware of all applicable safety rules.
- 8. Medical Surveillance:

All employees with the possibility of exposure should be checked to ensure that no medical condition exists which could:

 - a. Be aggravated by exposure.
 - b. Prevent personnel from properly wearing breathing apparatus.
 - c. Keep personnel from escaping in an emergency.
- 9. Effects of exposure:
 - (1.) Up to 100 ppm- short term exposures:
 - a. Smell of rotten eggs.
 - b. Burning of the eyes.
 - c. Respiratory tract irritation.
 - (2.) Up to 100 ppm – prolonged exposure:
 - a. Loss of sense of smell.
 - b. Drowsiness.
 - c. Severe eye and throat irritation.
 - d. Possible pulmonary edema (respiratory difficulties due to fluid in the lungs).
 - (3.) Exposure up to 600 ppm:
 - a. Loss of reasoning and balance.
 - b. Eventual unconsciousness.

- (4.) Exposures greater than 600 ppm:
 - a. All above symptoms.
 - b. Concentrations this high could result in immediate death.
- 10. Precautions while working in tanks or vessels:
 - a. See ***HSE.PRO.Confined Space Procedure.2022*** or
 - b. 29 CFR 1910.146 or 30 CFR 250.67

Revision History

Rev	Rev Date	Rev By	Approved By	Description
1.0	1.3.2022	Shayne Torrans	Shayne Torrans	Initial Procedure Document
1.1	12.5.2022	Shayne Torrans	Shayne Torrans	Format Revision

Approvals:

Procedure Owner

Print Name

Date

Signature

Competency Assessment

No.	Questionnaire	C/NYC
Q1		
A1		
Q2		
A2		
Q3		
A3		
Q4		
A4		
Q5		
A5		

Enclosed Attachments	
Risk Assessment	<input checked="" type="checkbox"/>
Environmental Aspect and Impact	<input checked="" type="checkbox"/>
Training and Competency	<input checked="" type="checkbox"/>
Measure and Evaluation Tools	<input checked="" type="checkbox"/>

Competency Checklist

To be filled out by Trainer and signed by Employee, Assessor and Supervisor before being returned to the HSEQT Manager for recording purposes.

Procedure	Competency	Date	Competent YES / NO	Employee Signature

(Please tick appropriate box)

This employee is competent in performing the job.

This employee has not attained the competency level.

*

***** *If the employee has not attained all competency levels, the General Manager must assess the action to be taken, provide an extension of training or alternative action as listed below.*

Alternate action to be taken: _____

Signed By	Employee:	_____	Date:	_____
	Trainer:	_____	Date:	_____
	Assessor:	_____	Date:	_____
	Regional Manager:	_____	Date:	_____

Environmental Aspects and Impacts

Identified Environmental Aspects and Impacts

The following table is a summary of the likely environmental aspects and impacts that may be identified during site inspections. The significance of each impact needs to be assessed using the Risk Assessment Model.

Activity	Aspect	Impact
Purchasing & Administrative Work	Consumption of goods	Conservation of natural resources
	Consumption of energy (eg. Electrical equipment and facilities)	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of waste (eg. Paper)	Consumption of space for waste disposal; Habitat loss
Climate Control	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of noise	Disturbance to community; Habitat loss
Cleaning of – offices / vehicles	Storage, use and release of chemicals	Contamination of air, water or soil; Risk to human health
Transport (Fleet vehicles / staff travel)	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Loss of habitat at all stages of generation; Light pollution
	Consumption of goods (eg. Oil)	Consumption of natural resources; Generation of waste; Habitat loss; Biodiversity impacts
	Generation of waste (eg. Oil)	Consumption of space for waste disposal; Potential contamination of water or soil; Habitat loss
	Exhaust emission	Release of greenhouse gases and atmospheric pollution
	Use of dangerous goods (eg. Batteries)	Potential contamination of air, water or soil; Risk to human health
	Generation of noise	Disturbance to community; Habitat degradation
Operations		

Risk Assessment

Risk Assessment // insert name here

Step No: Logical sequence	Sequence of Basic Job Steps documented in the Procedure, Work Instruction and project plans. Break down Job into steps. Each step should be logical and accomplish a major task.	Potential Safety & Environmental Hazards/Impacts at the site of the Job Identify the actual and potential health and safety hazards and the environmental impacts associated with each step of the job.	Risk Rating Refer to the risk matrix or HSEQT.PRO. Risk Mgt	Recommended Corrective Action or Procedure <i>Determine the corrective actions necessary to reduce the risk to as low as reasonably practical (ALARP) refer to HSEQ.PRO.Risk Mgt. The risk must be reduced or controlled to ALARP before work commences.</i> Document who is responsible for implementing the controls to manage each hazard identified.	Risk Rating refer to the risk matrix or HSEQT.PRO.Risk Mgt
1.					
2.					
3.					
4.					
5.					

Audit

Process: insert// Procedure: Insert //			Date:	Audited by:
			Location of Audit:	Area Mgr/Supervisor:
Item	Question	Evidence Sited	Comments	Conformance Score 0,3,5
1.				
2.				
3.				
4.				
5.				
6.				
7.				
AUDITOR'S SIGNATURE: SAFETY REP'S SIGNATURE:		CONFORMANCE SCORE: / 25 CONFORMANCE %:		0 – Non-Conformance 3 – Continuous Improvement Opportunity 5 – Total Conformance