SCOPE AND PURPOSE

This Standard identifies controls to reduce the risk of exposure to hydrogen sulphide (H_2S).

ROLES AND RESPONSIBILITIES

All employees, contractors and visitors must comply with this Standard.

Operations Managers are accountable to ensure high H_2S areas are identified, posted with warning signs and yellow chains, and fixed detectors and alarms in their area are maintained.

RISK ASSESSMENT

High H_2S areas include:

- Areas containing equipment that handle or potentially could handle streams with an H_2S concentration of 20,000 ppm or greater and where there is a higher likelihood for loss of containment.
- Areas between 500 - 20,000 ppm that have been determined to be high H_2S areas using the criteria set forth in Engineering Procedure – High H_2S Area Determination.

High H_2S areas are posted with yellow chain around the perimeter with the following signage:

- Where monitored with Fixed H_2S detectors – yellow sign **"High H_2S Area"**
- Where not monitored with Fixed H_2S detectors or insufficient monitors – red sign **"High H_2S Area"**

All other areas within the processing units, Offsites and Lab have the potential for H_2S exposure at lower concentration

The Buddy Role

A buddy must be familiar with the duties of the role and be SCBA trained.

A Buddy will:

- wear an identifying vest unless the buddy is an Operator
- observe workers from outside and upwind of the area perimeter
- immediately sound the alarm at the nearest rescue station should a worker be overcome, don SCBA, and wait for assistance
- not attempt to rescue a person on their own

NOTE:

The Buddy Role in the main flare area will follow a different procedure because the nearest rescue station in Plant 4 is too far away. For work in the main flare area, the Buddy shall have a radio set to the Plant 3 channel. Just before work begins the Buddy shall inspect the SCBA stored in the gray storage shed at the fence line to the main flare area. Ensure they have the proper sized face piece and the SCBA tank is full and ready for service. In the event a worker is overcome, the Buddy shall contact CB4 providing operations with the location. The Buddy shall don the SCBA and wait for assistance upwind of the site the worker was overcome. In the event of radio failure, the Buddy will report directly to CB4.

RISK CONTROLS

Fixed H_2S detectors have an initial alarm at 10 ppm and a second alarm at 15 ppm. These detectors also alarm in control centres to alert operations.

As per the Personal Protective Equipment standard, all personnel must wear one of the following personal H_2S gas monitors on the outside of their PPE when entering or working in process units, Offsites areas and the Lab:

- Wireless personal gas detector (WPGD); or
- Personal single-gas H_2S monitor.

Personal H_2S Gas Monitors must have a low alarm at 10 ppm and a high alarm at 15 ppm. The only exception to wearing a Personal H_2S Gas Monitor is while performing a task where the H_2S exposure exceeds the alarm limits and the worker is protected by fresh air. In these cases, it is permissible to remove the Personal H_2S Gas Monitor to prevent the device from being in a constant alarm mode.

Additional personal risk controls apply to high H_2S areas based on the risk of the task. The following risk controls are required in the defined tables below

Low H2S Exposure Risk Activities and Controls

Work activities may be considered for classification as “Low Risk” in classified high H_2S areas if the activity is non-intrusive work to process equipment and the activities listed in Table 1 are not likely to create any Loss of Primary Containment (LOPC).

TABLE 1

<table>
<tr><th>Low H_2S Exposure Risk Activities</th><th>Low H_2S Exposure Risk Controls</th></tr>
<tr><td rowspan="2">Please reference the list of activities provided in Appendix A:
Low H_2S exposure risk activities - general
Low H_2S Exposure Risk Activities specific to SIM work activities
Low H_2S Exposure Risk Activities specific to Operations work activities</td><td>Fixed H_2S Detector Monitors in the areas
  Personal H_2S Gas Monitor
1 Radio per working crew</td></tr>
<tr><td>No Fixed H2S Detector Monitor in the area
or
Insufficient number of fixed detectors in the area
  Personal H_2S Gas Monitor
1 Radio per working crew
Working Crew is 4 people or less</td></tr>
<tr><td colspan="2">RADIOS: A radio used by working crews is to be on the related operation channel indicated on the safe work the permit.</td></tr>
<tr><td colspan="2">IN THE EVENT OF AN EMERGENCY: You are to immediately notify operations by radio once in a safe location.</td></tr>
</table>

High H_2S Exposure Risk Activities and Controls

Intrusive process equipment work activities listed in Table 2 are considered to have a "High H_2S exposure risk" and defined controls shall be followed at all times.

TABLE 2

High H_2S Exposure Risk Activities	High H_2S Exposure Risk Controls
Open or breaking into H_2S rich or potentially H_2S rich equipment	• Personal H_2S Gas Monitor • Radio • "Buddy" with a radio • Supplied-air respirator • Barrier tape - as per "*USE OF DANGER TAGS AND BARRIER TAPE"* – *Document Number: 4000-ZSD-SMSAFESA-008668" section 4 – Green Tape (breathing air required)*
High H_2S Exposure Risk Activities specific to Operation work activities	**High H_2S Exposure Risk Controls specific to Operator activities**
Operators sampling potentially rich H_2S streams (Refer to Appendix B)	• Personal H_2S Gas Monitor • Radio • "Buddy" with a radio • Supplied-air respirator • Barrier tape - as per "*USE OF DANGER TAGS AND BARRIER TAPE"* – *Document Number: 4000-ZSD-SMSAFESA-008668" section 4 – Green Tape (breathing air required)* **NOTE:** Barricade tape is not required for sampling if the area has been cleared of unauthorized personnel.

H_2S Barricading Requirements

- Green barricade tape printed with **"Breathing Air Required"** will be used
- Proper barricading is the responsibility of the Unit Operator or contractor performing the work or the person who recognizes the hazard
- Barricading should be installed to encircle the immediate area to prevent entry
- At a minimum, barrier tape shall have a 20' radius from the work activity location
- Elevated areas affected by H_2S will also require barricading on an equal level to prevent exposure
- All points of possible entry into these areas must be considered so that entry is prevented by any personnel inadvertently entering the area

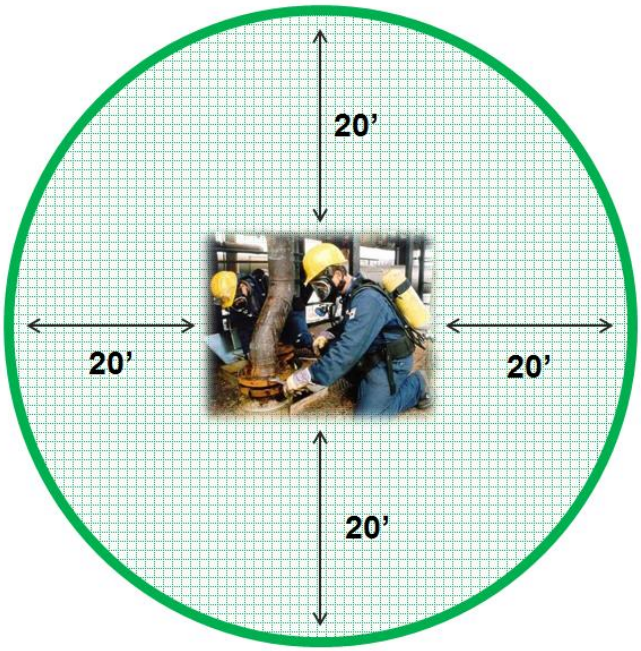


Figure 1 – Minimum Barricade Radius

RESPONSE TO AN H_2S ALARM

If a personal or fixed alarm sounds, workers will stop work, assess the wind direction and leave the area in a safe direction. Workers must contact Operations by radio immediately once in a safe location.

In either case, Operations will respond to the alarm and determine when it is safe to re-enter the area or resume work.

TRAINING

All workers must be trained in the hazards of H_2S and control measures.

REFERENCES

Personal Protective Equipment Standard

Respiratory Protection Standard

END OF STANDARD

REVISION LOG				
Date (MM/DD/YYYY)	**Revision**	**Section**	**Comments**	**Editor** (Name)
12/16/2007	Original	All	This new H_2S Standard replaces previous document Standing Order # 2.007 (Buddy System)	
03/01/2011	1	All	Re-defined High H_2S Areas and modified Task Risk / Risk Control Matrix	
03/04/2011	2	Risk Controls	Changes to Low and High Risk Maintenance Activities to clarify radio requirements	
06/27/2012	3	All	Updated format, but content was NOT altered	
07/24/2013	-	Header	Document Owner & Contact Updated. NO content change.	L. Lebert
02/10/2014	4	Risk Controls Appendix A	Personal H_2S Monitor not required while wearing fresh air Revised risk controls for low risk SIM activities Added Appendix A – Low Risk SIM Activities	D. Allen
09/05/2014	5	Buddy Role	Revised Buddy requirements for work in the main flare area	D. Allen
05/24/2018	6	H2S risk controls, Buddy Role, Appendix	Revised risk controls for H_2S areas Low H_2S exposure risk activities table added Revised Buddy requirements for work in the main flare area Added breathing tape radius best practice	T. Richard
10/01/2019	7	Document Contact	Reassigned from Safety Advisor to Occupational Hygienist	M. Chipman
		Risk Controls, Table 1, Table 2	Changed all personal H_2S monitor requirements to reflect new SPS monitors	
		References	Removed reference to procedure for old personal H_2S monitors Removed reference to (obsolete) H_2S High Risk Sample Points document Added reference to PPE standard	
		H2S Barricading Requirements	Added additional requirements listed in (former) Appendix – including Figure 1	
		Appendix A Appendix C	Separated (former) combined appendix information into individual topic-specific appendices	
		Appendix B	Added High H_2S Exposure Risk Sample Points list as appendix to standard	

General Work Activity

- Compressor performance data acquisition
- Engineering field checks
- Erecting or removing scaffold
- Fin fan belt changes
- Fin fan motor changes
- Garbage collection
- General clean up using manual tools (i.e., broom)
- Installation of piping, excluding process tie-in
- Installation of tubing, excluding process tie-in
- Installing insulation
- Lighting repairs
- Painting
- Planning assessments
- Removing insulation (not removing to verify if process equipment is leaking)
- Routine Air Conditioning Maintenance
- Routine Lighting Checks
- Routine Servicing of Overhead Lift Devices
- Routine Steam Trap / Tracing Maintenance
- Running fire hoses – staging in place only, not making connections
- Safety inspections
- Salt spreading
- Sketches / measuring (not requiring fall protection)
- Snow removal using manual tools
- Structural steel repairs
- Tours
- Utility (water, air, steam, condensate) repair activity to valves, piping, equipment
- Vibration monitoring of equipment
- Visual inspections
- Water distribution
- X-rays

Analyzer Overhauls and Repair Work

- Includes work taking place in monitored shacks where process has been isolated
- Analyzer troubleshooting, electrical and sample systems
- Tail Gas analyzers, CEMS stack analyzer, pH analyzers, etc…

Field Instrumentation

- Control valve inspections, evaluations and testing
- Control loop troubleshooting
- Any temperature loop validation, inspection, installation, repairs

Field wiring checks and repairs
• Air tubing repairs and installations • Radar level troubleshooting • Safety shower repairs • Junction box validations • Non-intrusive testing
Routine non-intrusive Analyzer PMs
• Production Analyzers • Environmental Analyzers • Health and Safety Analyzers (Field H_2S, HC and O2 detectors included) • Moving cylinder gases to and from analyzer shacks
Systems – PLC racks / Vibration Monitoring
• Works involves non-intrusive troubleshooting • Validation of programming and testing • Compressor probes, proximeters, vibration card racks • Draining knock out vessels to closed sewer systems • Opening isolation valves between H2S rich systems within a closed system and equipment that has been returned from having had maintenance performed on that equipment • Operating systems not containing H_2S • Operating utilities • Visual inspections

Process Engineering has provided a list of sample points that are deemed high risk due to potential for H_2S exposure and, therefore, require the use of supplied-air respiratory protection during sample collection.

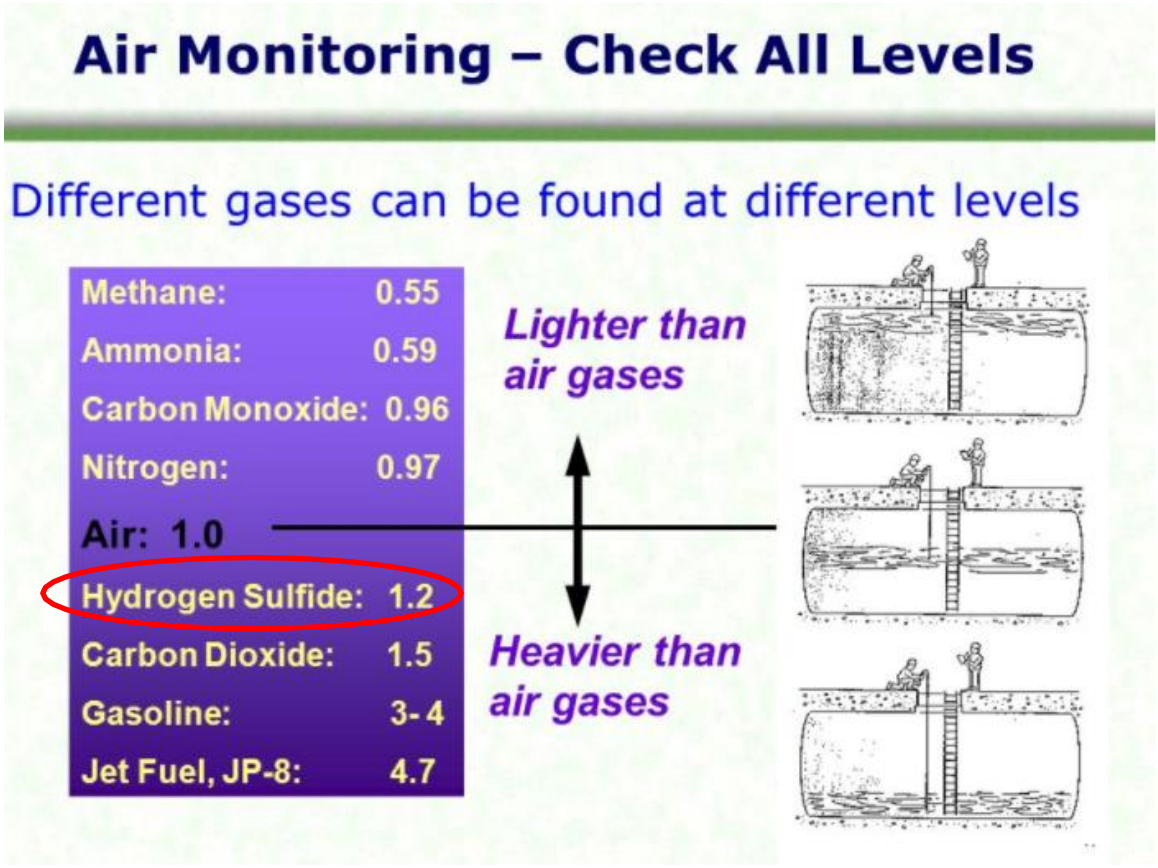
It is understood that this list is based on normal operating conditions. Process abnormalities may lead to the requirement for supplied-air respiratory protection for other sample points as well. In the absence of normal operating conditions, each sample point will have to be evaluated with the risks assessed and the appropriate controls identified.

- 12SPT-016: Stabilizer Reflux
- 18SPT-001: Absorber Overhead
- SPT @ 18FS02
- 21SPT-012: Plant 2 SWS Charge
- 21SPT-014: Plant 1 Flare Gas
- 21SPT-015: Plant 2 Flare Gas
- 22SPT-010: Sep Off Gas
- 25SPT-016: Vacuum Overhead water
- 31SPT-002 (31MGOR001): Reactor Effluent from 31R001
- 31SPT-003 (31GASRYHC): Recycle Compressor Gas
- 31SPT-010: From 31C002
- 31SPT-014 (31MGOR002): Reactor Effluent from 31R002
- 31SPT-055: Recycle Gas Compressor Quench Gas
- 31SPT-150: 31V102 Liquid Sample
- 31SPT-153: CLPS Liquid to Preflash Tower
- 31SPT-154: CLPS Vapour to Amine Treating
- 32SPT-001: Fuel Gas from Preflash Overhead
- 32SPT-149: Preflash Gas to Amine Contactor
- 34SPT-002: Acid Gas from 34V013
- 34SPT-010: Stripper Reflux
- 34SPT-011: Acid Gas
- 34SPT-013: LP Offgas
- 41SPT-002: Combined Gas to DHT
- 41SPT-003: CHPS Offgas
- 44SPT-001: Sour Gas Feed
- 44SPT-008: Sour Water Feed to Tank
- 44SPT-013: Sour Water to SW Stripper
- 44SPT-014: Sour Water Acid Gas to SRU
- 44SPT-015: SWS Pumparound

Hydrogen sulfide (H_2S), a colourless gas with the smell of rotten eggs and is dangerously reactive with strong acids and oxidizing materials. It can be found (in the oil and gas industry) in wellheads, well bores, piping systems, vessels, pipelines, tanks, production facilities, pits and low spots, confined or enclosed spaces, shacks or buildings, bermed or diked areas. It can be released from scales on metallic surfaces. It is soluble in water and hydrocarbon liquids and can be released from solution by agitation, pressure reduction and heat. As a component in a gas stream lighter than air it may rise and not fall even though it is slightly heavier than air. Over time it will eventually fall.

The following safety and health hazards may occur:

- Presence of H_2S gas released from gas or liquid streams (toxic hazard).
- Formation of explosive gas-air mixtures (explosive hazard).
- Presence of hydrocarbon gases or vapour (intoxication hazard).
- Lack of oxygen through displacement of air by hydrocarbon (asphyxiation).
- Presence of hydrocarbon gases or vapours – hydrocarbons with low levels of hydrogen Sulfide can have intoxicating effects before hydrogen sulfide concentrations reach toxic levels.



The following individuals have approved and signed this document.

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