TABLE OF CONTENTS

1. INTRODUCTION .............................................................. 2
2. SCOPE .............................................................................. 2
3. DEFINITIONS ............................................................... 2
4. REQUIREMENTS ............................................................ 3
5. RESPONSIBILITIES ....................................................... 8
6. REFERENCES ................................................................. 9

ATTACHMENTS ...................................................................... 9

APPENDICIES ......................................................................... 9
1. INTRODUCTION

In the course of normal operations, the primary risk of Hydrogen Sulfide (H₂S) release is generated by the loss or reduction of sour ethane feed, sour fuel gas or even general carry-over from nearby petrochemical facilities.

The fuel gas supply is normally sweet (contains no H₂S) but at times of shutdown or process upsets from the supplier facility, Q-Chem receives sour fuel gas up to 8,600ppm H₂S. Therefore, there is potential for H₂S exposure to personnel from time to time in any of the process areas.

The purpose of this program is to:

- Provide an awareness of Hydrogen Sulfide (H₂S).
- Protect employees and contractors from H₂S.
- Maintain H₂S exposures below the occupational exposure limit (OEL).
- Give guidance on potentially toxic areas and associated entry requirements.

2. SCOPE

This procedure is applicable to all personnel working on the Q-Chem facility who may have to work in areas, which present a risk of Hydrogen Sulfide release.

The main areas of the plant with the potential for H₂S exposure include:

- Incinerator
- Boilers
- Furnace Stacks
- Sulfur Recovery Unit (SRU)
- Tail Gas Treatment Unit (TGTU)
- Acid Gas Removal Unit (AGRU)

3. DEFINITIONS

**Acid Gas** is a term used to describe a process stream containing Hydrogen Sulfide (H₂S) and Carbon Dioxide (CO₂).

**Ceiling Limit** is the maximum allowable concentration of an instantaneous one time exposure within the duration of a shift (8hrs). H₂S Ceiling Limit is 20ppm.

**Escape Pack** is a small 10 minute compressed air bottle and mask that can be worn to escape from elevated structures if exiting a structure or platform.

**IDLH** is a concentration level referred to as Immediately Dangerous to Life and Health. H₂S has an IDLH of 100 ppm.

**Hydrogen Sulfide (H₂S)** is a heavy, colorless, flammable and toxic gas with a rotten egg odor at lower concentrations. Sense of smell diminishes with exposure and hence cannot be relied upon to warn of a continuous presence of
this gas. H₂S is a mucous membrane and respiratory tract irritant. Symptoms of acute exposure include nausea, headaches, delirium, disturbed equilibrium, tremors, convulsions and skin/eye irritations. Inhalation of high concentrations can produce extremely rapid unconsciousness and death (for more details refer to MSDS).

PPM is a term used to express concentration in Parts Per Million (PPM).

Threshold Limit Value (TLV) is a time-weighted average exposure concentration for a normal 8hr workday to which workers may be repeatedly exposed, day after day, without adverse effects. H₂S TLV is 10ppm.

Process Areas include all areas east of Road 1 where access is restricted due to the hazards inherent to the equipment, chemicals and energy involved.

SCBA is a method of respiratory protection Self Contained Breathing Apparatus.

Short Term Exposure Limit (STEL) is the maximum concentration to which workers can be exposed continuously for 15 minutes without suffering from severe health effects, irritation, and illness. H₂S STEL is 15ppm.

Sour Gas is a term used for gas containing H₂S.

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<td><strong>New H₂S TLV:</strong> The company has reviewed the new ACGIH adopted TLV for Hydrogen Sulfide [TLV = 1ppm and STEL = 5ppm]. As policy the company has adopted this new limit values, however the implementation date is pending feedback from CPChem Corporate. This delay is due to researching gas detection instrumentation in the market that would allow us to safely &amp; reliably adopt these changes. The limit value will be updated thereafter.</td>
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4. REQUIREMENTS

4.1 Entry into the Process Areas

4.1.1 All personnel entering the processing areas for any purpose other than a Formal-Guided-Tour must undergo Q-Chem General HazCom Training which incorporates H₂S Awareness. This training will cover the following topics:

- The hazards of the toxic gas.
- Portable Detectors and personal gas monitors.
- Field phones, fire and chemical release alarms.
- Plant evacuation and Assembly Points.
4.1.2 Requests for General HazCom Training must be submitted to the Q-Chem Training Department for scheduling and conducting.

4.2 Permanent High Risk H₂S Areas

4.2.1 Areas containing process streams with continuous high levels of H₂S are designated by Production Department and identified at their boundaries using Orange lines & Signs to indicate H₂S Areas:

- AGRU, SRU, TGTU
- Sulfur Pastillation Unit

4.3 Intermittent High Risk H₂S Areas

4.3.1 Areas containing process streams with H₂S on an intermittent or infrequent basis are designated by Production Department and identified at their boundaries using signs to indicate the hazard may be present.

- H₂S signs are located at ground level to elevated work platforms and openings below ground level.

4.3.2 Areas with no H₂S process streams, but due to their elevation, may present exposure risk from another unit or facility.

- High Elevations (Polyethylene Reactor Structure, Ethylene Furnace, Product Silos and Towers).

4.3.3 Production units must control entry into these areas when Q-Chem is informed by NGL facilities that the fuel gas is going off-spec and will be containing H₂S.

4.3.4 Hydrogen Sulfide created in sewage has an insidious behaviour, when the sewage is allowed to stand for a long time, H₂S can build up to a high concentration (up to 6000 ppm), and then gets quickly released when the liquid is disturbed, rapidly building up to a fatal concentration.

- Attempts to rescue unconscious people from spaces with high H₂S can lead to the death of the rescuers (often called “second man fatalities”)
4.4 Gas Detection

4.4.1 Fixed \( \text{H}_2\text{S} \) Detectors: Throughout the facility \( \text{H}_2\text{S} \) monitors are located at ground level and elevated locations to provide warning of measured \( \text{H}_2\text{S} \) levels above 10ppm.

- Detectors are located at strategic locations including the ventilation systems of some permanent buildings.

- The following actions occur when any of these fixed detectors alarm at 10ppm:
  - An advisory alarm is raised in the CCR (Central Control Room).
  - \( \text{H}_2\text{S} \) detectors located in the plant area and analyzer shelters will raise automatic audible & visual toxic alarm through Public Address and General Alarm (PAGA) system to inform site personnel of the zone location of the detected \( \text{H}_2\text{S} \) gas.
  - Additionally, blue strobe lights will activate in some specialized locations (noisy areas) e.g. Zone 2, 3 and 6 as a visual alert.
  - An automatic PAGA will not be raised from buildings & sulphur storage tank detectors. An internal building audible alarm will be sounded to evacuate the building occupancies.
  - An exception to this would be the Q-Chem central control room (CCR) which would act as a Shelter-in-place.

4.4.2 Personal Gas Monitors: A personal \( \text{H}_2\text{S} \)-toxiclip must be worn when entering the AGRU/SRU for any reason (Permanent High Risk \( \text{H}_2\text{S} \) Area)

- It is the responsibility of the department of the person entering the area to provide an \( \text{H}_2\text{S} \)-toxiclip and ensure training is completed / current.

- All gas monitors (personal or portable) issued by Production Department must be returned to the Unit FIC when leaving the restricted area.

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<td>Immediate evacuation of the affected process area is required when alarm is activated.</td>
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4.4.3 Individual Departments: Q-Chem departments must stock portable gas detection equipment for their personnel use. See Portable Gas Detector Procedure (HSE-SAF-PRO-00-0008).

- Q-Chem stocks H₂S-toxiclips and multiple gas detectors; these are available from the Warehouse.

4.5 Activation of Toxic Gas Detectors

4.5.1 Personnel working within a Permanent High Risk H₂S Area must make themselves aware of the Plant Emergency Procedures in relation to H₂S alarms.

4.5.2 The activation of a Toxiclip, portable detector or fixed plant detector will prompt personnel to leave the area immediately.

- All work must stop and Permits to Work (PTW) are cancelled for the affected area.

- Walk quickly upwind or crosswind to the nearest ASSEMBLY POINT.

- Await further instructions from the Incident Commander.

4.5.3 Windsocks are located at elevated positions around the site to assist with safe exit from the process areas to the ASSEMBLY POINT.

4.5.4 If H₂S alarm activates on a permanent building the Emergency Board Operator must notify the Fire & Safety Coordinator (FSC).

- Personnel must exit the building and proceed to their nearest assembly point.
  - Essential personnel located within the CCR would remain within the building as per site Emergency Response Plan requirements.

- FSC must respond to the building alarm and investigate. FSC checks with Board Operator to confirm if there are any unit upsets or not.
4.6 Shelter-in-Place

4.6.1 The Central Control Room (CCR), excluding the Laboratory, is the only designated Shelter-in-Place building.

4.6.2 Only essential personnel will be directed to this location during an H₂S emergency / evacuation.

4.6.3 HVAC system “Gas Tight Dampers” will close automatically from the fire & gas panel within the CCR.
   - The board operator can activate the dampers manually from the VDU if needed.

4.7 Breathing Apparatus

4.7.1 Escape Packs (compressed air units and masks) are located within the Permanent High Risk H₂S areas to cover emergency exit risks.
   - The number of escape packs is based on the number of operations and maintenance staff during normal operation periods.

4.7.2 At times of increased activity, the Production Unit must request additional escape packs from the Fire Department and issue them directly from the FIC’s to individuals who may be working in areas of impeded egress.
   - Contact the shift Fire & Safety Coordinator (FSC) for assistance.

4.8 Attempts to Rescue

4.8.1 A collapse of a person when working in a Permanent H₂S High Risk Area must be assumed and treated as an H₂S exposure. Your personal safety is the most important consideration, thus do the following:
   - Sound the emergency alarm.
   - Evacuate the area immediately.

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NOTE

Any attempts to rescue an unconscious person assumed to have been knocked down from H₂S is done only after sounding the plant alarm and under Self Contained Breathing Apparatus (SCBA).
4.9 Training

4.9.1 General Hazard Communication Training: is required for all persons entering the facility, with the exception of a Formal-Guided-Tour.

- Training validity is two years for employees and one year for contractors.

5. RESPONSIBILITIES

5.1 All Personnel (entering a Permanent High Risk H₂S Area)

- Have a personal gas monitor (H₂S Toxiclip)

5.2 Production Department

- Ensure portable gas detectors are managed properly, available in the FIC’s and calibrated ready for use.

5.3 Training Department

- Maintain the training module “General HazCom” which includes H₂S Awareness Training.

- Conduct the General HazCom Training.

- Maintain training records for all employees and contractors.

5.4 Industrial Hygienist

- Maintain and review the H₂S Program every three years.

5.5 Fire & Safety Coordinator

- Respond to any H₂S alarm on the plant site.

- Informing personnel at ASSEMBLY POINTS of action to be taken.

- Inspect Fire Station Escape Packs and SCBA and refill as required.
6. REFERENCES

- Title 29 of the Code of Federal Regulations, Section 1910.1000, Air Contaminants (OSHA).

- American Conference of Governmental Industrial Hygienist’s (ACGIH), Threshold Limit Values and Biological Exposure Indices Booklet.

ATTACHMENTS

None

APPENDICIES

None