

	Los Angeles Refinery	HSS-404	
	Hydrogen Sulfide Exposure Prevention	Page 1 of 29	
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1.0 INTRODUCTION

1.1 Purpose

HSS-404 defines the controls, safe work practices, and training requirements to minimize employee exposure to hydrogen sulfide (H₂S).

1.2 Scope

This standard is applicable to Marathon employees and contractor personnel at Los Angeles Refinery who are involved in work activities where there is potential for hydrogen sulfide exposure.



2.0 REFERENCES

2.1 Marathon Standards and Documents

- SAF-4010 Personal Protective Equipment
- SAF-4014 OSHA Hazard Communication
- HLT-2001 Industrial Hygiene Program
- HLT-2002 Hydrogen Sulfide Exposure Control Program
- HLT-2005 Respiratory Protection Program
- RSP-1701 H2S Exposure Control Program Minimum Requirements

2.2 Government Regulations

- Title 8, California Code of Regulations, Section 5155, Table AC-1, Permissible Exposure Limits for Chemical Contaminants
- Title 29, Code of Federal Regulations, Section 1910.1000, Air Contaminants Table Z-2
- Title 29, Code of Federal Regulations, Section 1910.1020, Access to Employee Exposure and Medical Records Standard

3.0 DEFINITIONS

The following definitions are applicable to this Standard.

Table 1 Definitions

Term	Description
Breathing Zone	The area within a one foot radius of the mouth and nose
Bump Test	Exposing a H ₂ S sensor to a concentration of H ₂ S known to be above the alarm point to make sure the sensor is working properly.
Calibration	Introduction of a known concentration of H ₂ S and adjustment of the instrument as needed for proper response and accurate reading.
Facility	Buildings, containers or equipment which contain a process.
Fixed H ₂ S Detector/Monitor	A stationary monitoring device, normally located in a process area, sour gas facility, analyzer shelter, air intake stack or duct which detects high levels of H ₂ S and displays a visual indication of H ₂ S detected and audible warning.

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Term	Description
Hydrogen Sulfide (H ₂ S)	A colorless and highly toxic gas that is also extremely soluble in water and liquid hydrocarbons. A natural component of crude oil and a by-product of some refinery processes. Depending on concentration, H ₂ S can be explosive, flammable, or corrosive, and is dangerously reactive with other chemicals. H ₂ S can be detected by its characteristic 'rotten egg' odor at low concentrations in the part per billion ranges, but because it temporarily deadens the sense of smell, odor is not an adequate means of detecting H ₂ S presence. CAS Registry number 7783-06-4.
H ₂ S Stream	For the purpose of this document, a hydrogen sulfide stream is defined as any gas, vapor or liquid that can release 10ppm or more of H ₂ S into the breathing zone or into an area that may become the breathing zone of employees.
High H ₂ S Unit	<p>Operating units or bulk storage areas that contain streams or materials that meet the H₂S Stream definition. Such areas may include but are not limited to:</p> <ul style="list-style-type: none"> • Catwalks and inside of dikes around sour tanks • Floating roofs of tanks containing or previously containing crude oil, slop oil, sour water, high sulfur fuel oil or any material with detectable H₂S • Areas around gauging hatches or other openings on fixed roof tanks containing sour material • Sour or foul water stripper units, amine units and sulfur plants • Tail gas (Beavon-Stretford) open reaction/regeneration tanks • Sour gas or recycle gas compressors • Process units that handle hydrogen sulfide streams
Immediately Dangerous to Life and Health (IDLH)	<p>The lowest atmospheric concentration of any toxic, corrosive or asphyxiating substance that poses an immediate threat to life or would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere.</p> <p>NIOSH IDLH is 100 ppm. Note: The IDLH value is based on the consequence that might occur after a 30 minute exposure and every effort should be made to exit immediately.</p>

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Term	Description
Job Hazard Analysis (JHA)	A technique to identify existing and/or potential hazards of a specific job or task that is performed prior to beginning the job. A completed JHA will include practices to eliminate, mitigate or control any identified hazards of the job/task.
National Institute for Occupational Safety and Health (NIOSH)	U.S. federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH is part of the Centers for Disease Control and Prevention (CDC) in the U.S. Department of Health and Human Services.
Occupational Exposure Limit (OEL)	The allowed occupational exposure for Marathon employees based on Marathon’s use of industry best practice and/or Marathon’s risk tolerance. OEL for an 8 hour shift is 10ppm.
Occupational Safety and Health Administration (OSHA)	A division of the U.S. Department of Labor that serves as the main federal agency that sets and enforces health and safety rules for workplaces.
Parts Per Million (ppm)	Concentration of air contaminate per million parts of air
Personal H ₂ S Monitor / Alarm	Gas detectors for personal use, small enough to be clipped onto exterior clothing. Personal alarms alert personnel to presence of the toxic gas they were designed to detect in the local atmosphere. They provide continuous, direct reading gas detection with visual and audible alarms, and are designed to be worn when working in locations where toxic gases might be released. The terms personal H ₂ S monitor and personal H ₂ S alarm are used interchangeably.

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Term	Description
Regulatory Exposure Limits 1. Permissible Exposure Limit (PEL) 2. Short Term Exposure Limit (STEL) 3. Ceiling	The maximum concentration of an airborne contaminant to which a worker may be exposed averaged over a period of time. 1. OSHA PELs are usually expressed as an 8 hour Time-Weighted Averages (TWA). PELs may also be a TWA other than 8 hours. The Cal-OSHA 8 hour TWA for H ₂ S is 10 ppm. 2. A 15 minute TWA exposure to an airborne contaminant which is not to be exceeded at any time during the workday. The Cal-OSHA STEL for H ₂ S is 15 ppm. 3. Ceiling is the maximum concentration of an airborne contaminant to which an employee may be exposed at any time. The Cal-OSHA Ceiling for H ₂ S is 50 ppm for a 10 minute maximum peak, if no other measureable exposure occurs during the workshift.
Self-Contained Breathing Apparatus (SCBA)	An atmosphere-supplying respirator for which the source of breathing air is designed to be carried by the user.
Supplied Air Respirator (SAR)	An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user. Breathable air is provided from a stationary source.
Time Weighted Average (TWA)	Exposure to a chemical or physical agent over a specified period of time. The time period is generally understood to be 8 hours unless otherwise marked, such as TWA-10, meaning that the exposure time was averaged over 10 hours or TWA-12 meaning that the exposure time was averaged over 12 hours. Cal-OSHA TWA for an 8 hour shift is 10ppm.

4.0 RESPONSIBILITIES

4.1 All Personnel

Shall be responsible for:

- a. Wearing a personal H₂S monitor in accordance with Section 5.2.

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- b. Participating in H₂S exposure assessments as appropriate.
- c. Receiving awareness training on the hazards of H₂S, use and limitation of personal H₂S monitors, response to alarms, and required safe work practices.
- d. Reporting any H₂S odors detected in the plant to the 501/Refinery Shift Superintendent (RSS).

4.2 Occupational Health

Shall be responsible for:

- a. Conducting air monitoring to assess employee exposure to H₂S in units where H₂S is a component of refinery streams. Periodic monitoring of full shift, short term, and peak exposures will be conducted by the Occupational Health group per exposure assessment plan.
- b. Identifying and documenting areas that contain or are likely to contain H₂S process streams. Process changes will be captured through the Management of Change process and updated accordingly.
- c. Identifying jobs/tasks involving exposure to H₂S that require the use of additional controls.
- d. Responding to leaks, alarms, and releases where H₂S may be present in order to provide support in quantifying concentrations, identifying sources, and determining if additional controls are needed.
- e. Conducting H₂S monitoring, when necessary, to further investigate recurring alarms and determine if alarm event is considered a Health-Related Incident (HRI).
- f. Administering the personal H₂S monitor program, tracking, and follow-up.
- g. Conducting and updating on initial and refresher training on H₂S Exposure Prevention. Training may be provided in the form of computer-based training (CBT).
- h. Serving as a point of contact for questions regarding monitoring or PPE requirements.
- i. Reviewing this document on an annual basis.

4.3 Authorized Gas Testers

Shall be responsible for:

- a. Performing gas testing prior to issuing permits that allow hot work or confined space entry where potential exposure to H₂S exists.
- b. Determining additional controls based on gas testing results.
- c. Responding to leaks or releases where H₂S may be present.

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- d. Notifying the Occupational Health group if job scope may be an H₂S exposure concern.
- e. Ensuring safe work practices and personal protective equipment (PPE) identified by this procedure are followed.

4.4 Operations and Maintenance

Shall be responsible for:

- a. Awareness of the refining processes and process streams that can present an H₂S exposure hazard and work practice controls to mitigate exposure potential.
- b. Awareness of H₂S hazards associated with exposure and identifying the work practice controls listed in Section 5.1 necessary for performing or permitting work.
- c. Wearing personal H₂S monitors and following requirements for bump testing and monthly calibration, maintaining and/or replacing monitors.
- d. Adhering to work practice controls applicable to the job task being performed and wearing proper respiratory protection and PPE as required in Table 6.
- e. Notifying the Health group of new or non-routinely performed tasks that may present an exposure to H₂S.
- f. Reporting personal H₂S monitor alarms to supervision, and submitting appropriate notifications per Section 5.5.
- g. **Operations only:** Investigating H₂S monitor alarms that occur in their area and determining if actions required to isolate the source of H₂S require SAR or SCBA respiratory protection, and/or emergency response assistance.

4.5 Electrical/Instrumentation Department

Shall be responsible for:

- a. Calibrating and maintaining fixed H₂S area monitors located in various process areas throughout LAR.
- b. Maintaining logs for preventive maintenance.

4.6 Operations Support Engineering

Shall be responsible for:

- a. Coordinating sampling of refinery streams for analysis by the LAR Laboratory to quantify concentration of H₂S in the stream.
 - This information shall be supplied to the Occupational Health group for inclusion in applicable Safety Data Sheets (SDS).

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- b. Ensuring changes are captured through the Management of Change (MOC) process when a process change impacts stream composition of H₂S.
 - Process changes may require equipment labeling and orange color coding changes to meet H₂S identification requirements.

4.7 Pressurized Equipment Integrity Engineering

Shall be responsible for:

- a. Ensuring design considerations for new or modified equipment in H₂S streams. These may include but are not limited to:
 - Proper metallurgy
 - Closed sampling systems
 - Welded connections up to the first block valve
 - Relief valve systems discharge to flare
 - Process sewers and drains properly vented to approved locations
 - Assessing need for double or tandem seals on pumps in H₂S stream service
 - Proper shaft seals for compressors
 - Continuous monitoring and alarm systems for:
 - Analyzer buildings
 - Process units
 - Laboratories
 - Air intake stacks

The following Andeavor legacy standards deal with design and specifications for equipment in H₂S stream service.

- TES 311, ASME Vessel Fabrication
- TES311C1, Low Alloy Vessels/Exchangers
- TES 910, Material Selection Guide
- TES 913, Material Selection for Piping in Aggressive Service
- TRS 661, Risk Based Inspection for Fixed Equipment

Other Marathon or Industry standards may also be applicable. Consult the Marathon Corporate Engineering Group for comprehensive information on design of equipment in H₂S stream service.

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4.8 Contractor Personnel

Shall be responsible for:

- a. Providing their own personal monitors and calibration stations, and shall wear monitors in accordance with Section 5.2.
- b. In the event of an H₂S incident, data from the monitor may be downloaded and reviewed as part of the investigation.
- c. Personal alarms shall be immediately reported to contractor supervision, Operations, and Health for follow-up and clearance to continue work.

4.9 Safety Issue

Shall be responsible for:

- a. Issuance, maintenance, troubleshooting, and replacement of LAR personal H₂S monitors and docking stations.

5.0 PROCEDURE

5.1 Safe Work Practices

5.1.1 Identification of H₂S-containing Process Streams

- 1. Existing flanges on piping and equipment containing process streams which contain 500 ppm or greater H₂S are painted orange at Carson
 - i. "Acid Gas" piping running from the North and South Area Amine units to feed the Carson Sulfur Plant contains more than 90% H₂S and is painted orange along the entire pipe run.

NOTE
This is an indicator and shall not be relied on solely.

- 2. Sign postings in specific locations alert personnel of the potential presence of H₂S for specific equipment and pits.
- 3. Table 4 identifies process stream locations containing H₂S greater than 0.1%. Associated process stream locations and equipment can be referenced electronically via the online SDS system.

5.1.2 Engineering Controls for H₂S Equipment

- 1. Utilize closed-system sampling stations.
- 2. Tandem seals on pumps handling H₂S process streams

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5.1.3 Work Practice Controls for H₂S Equipment

1. Isolate equipment from the source of H₂S per Isolation standards LOTO Control of Hazardous Energy and Lockout/Tagout for Turnarounds
2. Purge equipment with water, steam, or nitrogen.
3. Ventilate process equipment with the use of Coppus blowers or exhaust fans.
4. When sampling and depressuring H₂S streams from process equipment, check the wind direction and stand upwind prior to collecting a sample or depressuring H₂S equipment.
 - i. Readjust and/or stop if monitor alarms and seek additional assistance when necessary.

5.2 Personal H₂S Monitors

- a. A personal H₂S monitor does NOT provide any type of protection against H₂S. Do not use personal H₂S monitors as leak detectors. A multi-gas monitor can be used for this purpose.

NOTE
Multi-gas monitors can be obtained from an Operations foreman or Health & Safety representative.

- b. Personnel working in process areas where unit sign-in and sign-out is required shall wear a personal H₂S monitor.
- c. Individual H₂S monitors are not required for escorted site visitors when accompanied by an MPC employee(s) with a monitor.
- d. Exemptions for the above requirement include the following units and tasks:
 1. SCBA/SAR Tasks

NOTE
Area where SCBA/SAR is used must be barricaded to prevent unauthorized entry.

2. Asbestos work
3. Hydroblasting activities
4. Fire Brigade response
5. Delivery drivers not performing work inside of a process unit
6. Carson-specific Locations
 - i. Blue Barn

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7. Wilmington Calciner

5.2.1 Monitor Requirements

1. The approved personal monitor for Marathon LAR personnel is the Industrial Scientific Tango.
2. Personal monitors shall be set to alarm at 10 ppm (low alarm) and 15 ppm (high alarm).
3. Monitors shall be minimally equipped with both latching audible and visual signals to alert the user when alarm set points have been exceeded. Audible alarm will not clear until monitors are docked on the docking station.
4. Monitors shall have the ability to download data on a docking station, and docking stations shall be made available for calibration, bump testing, and downloading alarm data.
5. An amplifier attachment to increase the audible alarm level for the Industrial Scientific Tango monitor is available and stocked at the storehouse.

5.2.2 Monitor Placement

1. Monitors shall be worn within 12 inches of the breathing zone and placed in a way where it does not hinder line of vision.
2. Monitors can be worn on the side of hard hats but not on the back.
 - i. If working in high noise areas, monitors without amplifier attachment must not be placed on the hard hat to ensure visual alarm can be seen.
3. Monitors cannot be worn on belts on the waist or back. Do not attach monitor to radios.
 - i. Any exemptions to the placement of the monitor shall be approved through the Medical Department.
4. The sensor shall not be obstructed by garments, decals, or tape.
5. Monitors shall be worn on the outermost layer of clothing.

5.2.3 Issuance to Marathon employees

1. Personal monitors are issued by Occupational Health after personnel receive training on the monitor and intended use.
 - i. Monitors can be marked for identification purposes, however, do not use decals that will obstruct the sensor or display window

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- 2. Non-functioning monitors shall be returned to Safety Issue for replacement. Non-functioning monitors shall not be disposed of as waste.
- 3. Replacements or loaner monitors can be obtained from Safety Issue after completing the form in Appendix E.
 - i. Occupational Health approval is required to assign temporary personal H₂S monitors to visitors and agency employees.
 - ii. Contact the 501/Refinery Shift Superintendent (RSS) for after-hours issuance.

5.2.4 Monitor Maintenance

- 1. Monitors shall be docked every shift worked, and after any alarms occurring in the field.
- 2. Monitors shall be calibrated at least once per month.
- 3. If monitor does not pass calibration or bump testing, the monitor shall be replaced immediately. Monitor replacement or troubleshooting can be obtained at Safety Issue.

5.3 Fixed Location H₂S Monitors

- a. Refer to standing instruction SAF-066, Fixed Area Monitors.
- b. Fixed area monitors are typically located in or near process areas where H₂S releases are likely to occur. The locations are chosen based upon the H₂S content in a process stream and its associated hazard potential should there be an equipment leak or failure.
 - Monitors shall be utilized and maintained as the primary means of detecting and warning of potential H₂S releases that may pose a hazard to employees.
 - Fixed area alarms shall be reported through the SAF-012 Near Miss First Report form.

Fixed monitors are set to alarm as low as 10 ppm and are maintained by the Electrical group (Carson) and the E&I group (Wilmington).

5.4 Personal Protective Equipment (PPE)

- a. The appropriate respiratory protection for personnel performing a job/task where exposure to H₂S is a concern is supplied/fresh air. Supplied air respirators may be SAR or SCBA. Job tasks requiring respiratory protection are listed in Table 6.
 - All personnel using these respirators shall have a standby present with a SCBA available in case of emergency. Standby personnel will

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be required to wear a SCBA on their back with the mask out of the plastic wrap and ready for use.

5.5 Alarm Reporting

- a. Follow instructions on Figure 1 for responding to a personal H₂S monitor alarm.
- b. Report and document alarm events, peak readings and activity being performed at the time of the alarm event to unit operations and foreman for your craft or department.
 - 1. If exposure symptoms listed in Table 3 are experienced, seek medical attention.
 - 2. If Supplied Air equipment is worn for the task, alarm events with peak readings at or exceeding 50 ppm **do not** require a SAF-012 submission. An H₂S Alarm Notification Report is still required to identify the trigger for the alarm.
 - 3. If peak readings from the personal H₂S monitor are at or exceeds 50 ppm without the use of supplied air respiratory protection, a SAF-012 form shall be submitted for Category 2 investigation.
 - 4. If monitor alarms at or above 100 ppm without the use of a supplied air respirator, seek medical attention.
 - 5. Employee or employee’s supervisor shall document alarm events, peak readings and activities by completing the H₂S Alarm Notification Form.
 - i. Only one (1) notification form is required per event, and can contain multiple entries for employees whose monitor alarms activated during the event.
 - ii. Only the highest peak needs to be documented. See Section 7.0 for a sample H₂S alarm notification form.
 - iii. Alarm events from bump testing and calibration procedures do not have to be documented.
- c. OSHA Maximum Peak
 - a. Since the OSHA Maximum Peak for H₂S is 50 ppm, employees who are exposed to 50 ppm or greater without supplied air respiratory protection must be protected from additional H₂S exposure for the remainder of that work shift.

Protection can include:

- i. Reassignment for the remainder of the shift to a job or task with limited exposure to H₂S,

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- 1. Job tasks with potential to expose employees to H2S are listed in Table 6.
- ii. Replacement by another qualified worker, or
- iii. Continuation of normal duties with the recognition that any job that has the potential for H2S exposure must be performed in SCBA, SAR **or** by another qualified worker.

5.5.1 H₂S Release/Leak Alarm Response

- 1. Upon audible or visual alarm activation, stop work and evacuate the area cross or upwind of fixed monitor by checking wind direction
- 2. Report alarm to Operations personnel. ALL personnel shall immediately evacuate upwind and leave the unit in an orderly manner.
- 3. Operations personnel shall don unit SCBAs before returning to the unit to investigate and correct the source of H₂S release or leak.
- 4. Maintenance and contractor personnel shall not return to the unit until advised by Operations personnel that it is safe to do so.
- 5. If it the source of the H₂S release or leak cannot be located or isolated, then an H₂S emergency exists.
 - i. If it is determined that an H₂S emergency exists and the detection system alarm has not sounded, then Operations personnel shall activate the unit call horn to sound an emergency alarm.

5.5.2 Alarm Interferences

- 1. Interferent materials may give an inaccurate gas reading and/or cause the monitor to alarm. It is important to understand these potential interferences, but **do not** assume the alarm is a false reading. Respond as if it is an accurate reading and reassess the situation.
 - i. A colorimetric diffusion detector tube can be used to verify and confirm positive interference.

NOTE

Interferent alarms may still warrant additional follow up with a Certified Gas Tester, Health, or Safety with the use of multigas meters or colorimetric detector tubes.

5.5.3 Potential interferences include:

- ii. Isopropyl Alcohol

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- iii. Hydrogen Gas
 - verify with a colorimetric detector tube for H₂S or Hydrogen
- iv. C3-C4 light hydrocarbon vent gases that do not contain H₂S.
- v. Diesel Exhaust – from the oxides of nitrogen (NO_x).
- vi. Radiofrequency (RF) transmittal

5.6 Training

- a. Annual training may be provided in the form of computer-based training (CBT).
- b. Personnel issued monitors (multi-gas or personal) shall be trained in the hazards of H₂S, equipment use, and limitations.
- c. Health effects of H₂S, alarm sounds and appearance, plant maps, information of locations and identification of H₂S streams and locations, evacuation procedures and related information shall be covered in new hire training for Marathon employees, and shall be covered in the contractor site-specific safety orientations.

5.7 Management of Change (MOC)

- a. As new information regarding the health hazards associated with exposure to H₂S become known, or as regulations or exposure guidelines change, the Occupational Health Group will communicate information to personnel through training sessions or other appropriate means.
- b. As unit processes change and/or as new units come on line, and as more analytical information is determined, the SDS and Equipment Labeling Table will be updated to reflect the changes in H₂S content in refinery streams and location of these streams. These changes will be part of the MOC reviews.

5.8 Record Keeping and Reporting

- a. H₂S exposure monitoring data, alarm notifications, process stream SDS and the equipment labeling tables will be maintained by the Occupational Health Group.
- b. Training records are maintained by the Training Department.

6.0 APPENDIX

Table 2 Physical Characteristics of H₂S

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6	Sharon Callahan	Sharon Callahan	2/5/20
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Molecular Formula	H ₂ S
Specific Gravity	1.189 (Air = 1)
Flammability	Flammable
Ignition Temperature	500°F
Explosive Range	4.3% to 46% by volume in air

Hydrogen sulfide (H₂S) is an extremely toxic substance. H₂S is slightly heavier than air and may accumulate to dangerous concentrations in low-lying areas and confined spaces, thereby causing asphyxiation. H₂S burns readily with a blue flame and produces sulfur dioxide. It also forms explosive mixtures with air.

H₂S is water soluble and can be carried in water streams through the sewer system. Since it is highly reactive with oxidizing materials such as chlorine and peroxides, H₂S can be released from water or caustic streams by the combination of heat and acids. For this reason, the potential exists for H₂S evolution from any open sewer connection.

H₂S has a very low odor threshold below 1 ppm. The ability to detect the classic "rotten egg" odor can easily be lost at relatively low concentrations.

This gas does not have adequate warning properties because olfactory fatigue sets in after prolonged exposure starting at 100 ppm. Olfactory fatigue is the temporary inability to distinguish a particular odor after (1) a prolonged exposure to that odor or (2) an exposure to a "threshold" concentration of that odor. After leaving an area of "elevated" odor, olfactory sensitivity is restored with time.

Table 3 Exposure Concentrations and Health Effects from H₂S Exposure

Concentration (ppm)	Health Effects
0.01 – 0.3	Odor threshold (highly variable)
1 – 5	Moderate offensive odor, may be associated with nausea, tearing of the eyes, or headaches

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Concentration (ppm)	Health Effects
20	Odor very strong; conjunctivitis may occur
20 – 50	Conjunctivitis and lung irritation
100	Eye and lung irritation; olfactory paralysis, odor disappears
150-200	Sense of smell paralyzed; severe eye and lung irritation
500	Serious damage to eyes within 30 min; severe lung irritation; "knockdown" and asphyxiation
1000	Breathing may stop within one or two breaths; immediate collapse

Source: 2015 Hamilton & Hardy's Industrial Toxicology, Sixth Edition

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Table 4 Carson Process Streams Containing Greater Than 0.1% H₂S

Process Stream/SDS Name	%Low	%High	Process Areas
Water Saturated Ammonia-Hydrogen Sulfide Gases	0.10%	0.70%	Sulfur Unit
Amine Gas, High H ₂ S	90.00%	98.00%	Coker, FCC/#4 Steam Plant, SFIA, Sulfur Unit, Waste Water
Acid Scrubber Off Gas	30.00%	80.00%	Sulfur Unit
Sour Refinery Gas (Replaced RS 018)	0.02%	60.00%	#1Ref/HDS, #2/#3 Reformer, Alky Complex, Coker, Crude/Vacuum Units, Isom Complex, FCC/#4 Steam Plant, Hydrocracker, SFIA, Sulfur Unit, Waste Water
Hydrogen Rich, Sour Refinery Gases (RS 041)	0.01%	8.00%	Hydrocracker, Isom Complex, #1Ref/HDS, #2/#3 Reformer, FCC/#4 Steam Plant, SFIA
Main Reactor Furnace Effluent	0.00%	19.00%	Sulfur Unit
Sulfur Plant Gas	0.10%	3.00%	Sulfur Unit
Merox Unit Foul Air	0.00%	5.00%	Alky Complex, SFIA, Sulfur Unit, Waste Water
Butane-Propane With H ₂ S	0.00%	1.00%	Isom Complex
Distillate with Sulfur, Benzene	0.00%	1.00%	Hydrocracker
Sour Naphtha/Hydrogen Mixed Phase Refinery Stream	0.00%	2.00%	#1Ref/HDS, #2/#3 Reformer
Refinery Mixed Slops	0.00%	1.00%	Coker, Storage & Handling
Sour Crude Oil (High H ₂ S potential)	0.10%	0.50%	Crude/Vacuum Units, Storage & Handling
Spent Sodium Hydroxide	0.10%	0.70%	Alky Complex, Cogen, Crude/Vacuum Units, FCC/#4 Steam

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Process Stream/SDS Name	%Low	%High	Process Areas
Solution			Plant, SFIA, Storage & Handling
Sour Water	0.00%	0.70%	#1Ref/HDS, #2/#3 Reformer, Alky Complex, Coker, Crude/Vacuum Units, Isom Complex, FCC/#4 Steam Plant, Hydrocracker, SFIA, Storage & Handling, Sulfur Unit, Waste Water
Rich Amines	0.10%	0.70%	#1Ref/HDS, #2/#3 Reformer, Coker, FCC/#4 Steam Plant, Hydrocracker, Isom Complex, Sulfur Unit

Table 5 Wilmington Process Streams Containing Greater Than 0.1% H₂S

Process Stream/SDS Name	%Low	%High	Process Areas
Acid Scrubber Off Gas	30.00%	80.00%	Los Angeles Refinery (LAR)
Spent Caustic Solution	0.10%	0.70%	Alky, C4 Isom, CRU-2, All, ETD, FCCU,RP&S, SRP
Coker Injection Sludge	0.00%	0.10%	LAR
Sour Heavy Crude Oil	0.10%	0.50%	BWTU, Crude, RP&S
Sour Light Crude Oil	0.10%	0.50%	BWTU, Crude, DCU, RP&S
Decant Oil	0.00%	0.10%	LAR, RP&S
Heavy Distillate	0.00%	<0.10%	Crude, DCU, FCCU, HCU, HTU-4, RP&S
Sour Refinery Fuel Gas	>162ppm	12.5%	Alky, Crude, LAR, Bensat, CRU-2, CRU-3, DCU, FCCU, FGR, HTU-2, HTU-3, HTU-4, SP&W, SRP
Hydrogen Sulfide	90.0%	100%	Alky, CRU-3, DCU, GCP, HCU, HGU-1, HTU-1, HTU-2, HTU-3, HTU-4, SRP

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Process Stream/ SDS Name	%Low	%High	Process Areas
Lean Amines	0.00%	0.1%	LAR
Mercox Unit Foul Air		<5.00%	LAR
Untreated Naphtha	0.00%	0.10%	LAR, HCU, SRP,
Rich MDEA in H2S Service	0.00%	6.00%	SRP, LAR,
Heavy Slop Oil	0.00%	1.00%	LAR, Crude, DCU, ETD, HTU-4, RP&S
Light Slop Oil	0.50%	0.75%	LAR, FGR
Sour Water with H2S		<1.00%	Bensat, LAR, Crude, CRU-2, DCU, ETD, FCCU, FGR, GCP, HCU, HTU-1, HTU-2, HTU-3, HTU-4, RP&S, SRP
SRU Tail Gas	0.00%	10.00%	LAR
Stripped Sour Water	0.00%	0.10%	BWTU, LAR, DCU, ETD, HCU
Spent Sulfuric Acid			Alky

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Table 6 Job Tasks and Respiratory Protection Requirements

Job Type	Job Task for H ₂ S Equipment	Minimum Respiratory Protection
Sampling and Depressuring H ₂ S Streams from process equipment	Check the wind direction prior to collecting a sample or depressuring H ₂ S equipment and stand upwind.	Check the wind direction prior to collecting a sample or depressuring H ₂ S equipment and stand upwind. Readjust and/or stop if monitor alarms and follow alarm flow chart (Figure 1)
Blinding/Line Breaks	Blinding and opening equipment in H ₂ S service as indicated by process stream	Fresh Air Equipment (Supplied Air or SCBA)
Hot Work on H ₂ S Equipment	Hot work on equipment that held a process stream containing H ₂ S	Fresh Air Equipment (Supplied Air or SCBA)
Confined Space Entry into H ₂ S Equipment	Confined space entry on equipment that held a process stream containing H ₂ S	Fresh Air Equipment (Supplied Air or SCBA) Any gas checks at or above an H ₂ S concentration of 100ppm (IDLH) shall require a Team Risk Assessment prior to entry (TRA).
Equipment Leaks/Releases	Tightening up or responding to leaks/releases on equipment in H ₂ S service as indicated by process stream	Fresh Air Equipment (Supplied Air or SCBA)
Tank Roof Activities	See F/S 660 Appendix A - Tank Roof Access Requirements and RP&S procedures for respiratory selection	
Work activities identified through Risk Assessments	Tasks on equipment in H ₂ S service as indicated by process stream	See Note 1 - Fresh Air Equipment (Supplied Air or SCBA)

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Job Type	Job Task for H ₂ S Equipment	Minimum Respiratory Protection
Incident Response	Responding to an uncontrolled release of an H ₂ S containing stream	Fresh Air Equipment (Supplied Air or SCBA)
H ₂ S Alarms triggered by any activity	Continuing task with an alarm that has not stopped by repositioning and/or closing off source	Fresh Air Equipment (Supplied Air or SCBA) for alarms lasting over one (1) minute
Fixed H ₂ S Monitor Alarms	Investigating fixed monitor alarms	Fresh Air Equipment (Supplied Air or SCBA)

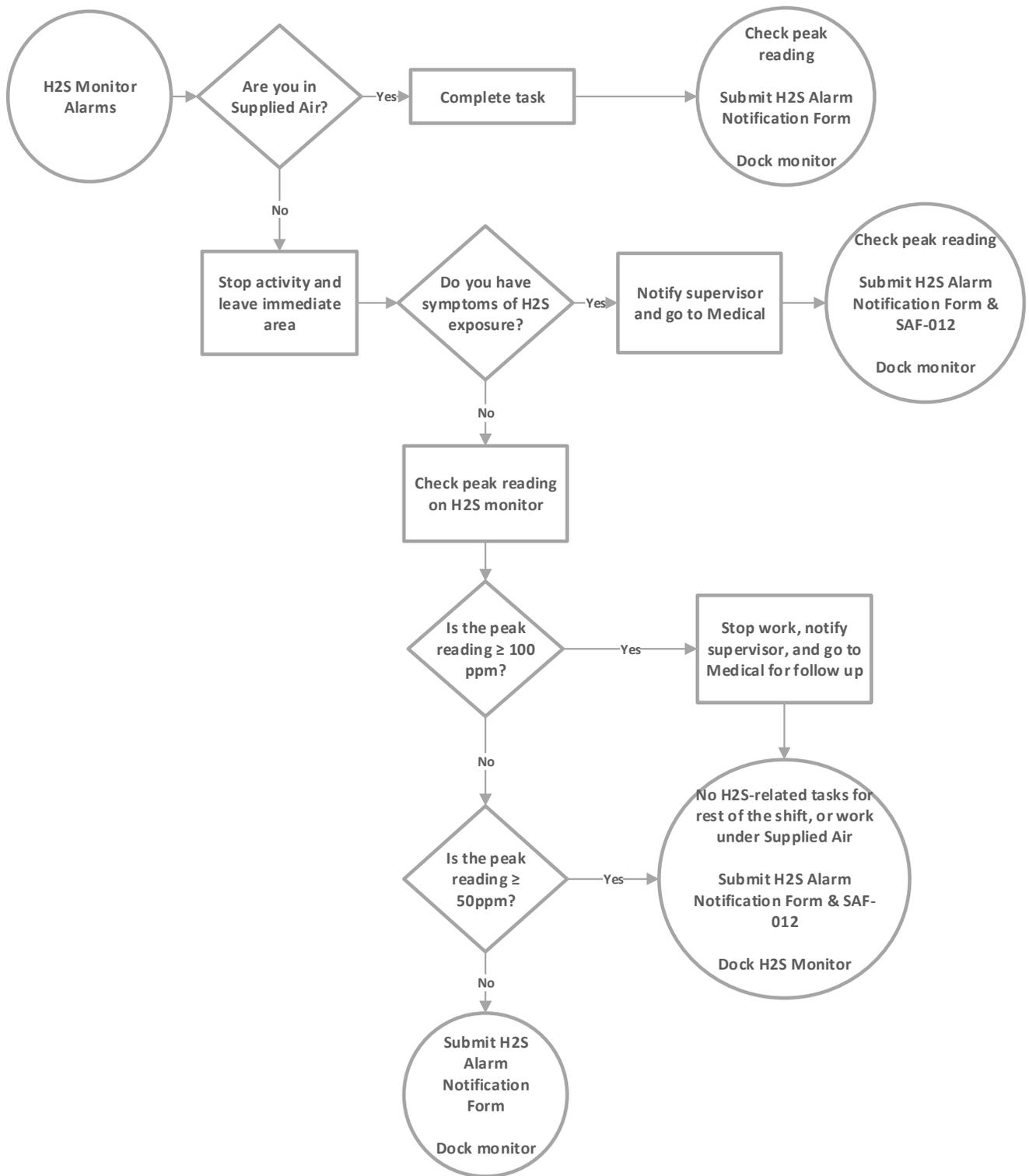
Note 1: If properly isolated, steamed, cleaned or purged, a direct read gas test by a certified gas tester, Health, or Safety Department may lower the level of respiratory protection required, and shall be documented on the permit.

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FIGURE 1 ALARM EVENT FLOWCHART

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7.0 H₂S ALARM NOTIFICATION REPORT

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Los Angeles Refinery
H2S ALARM NOTIFICATION REPORT

LOCATION
ORGANIZATION
AREA/UNIT

ALARM OCCURRED (Date)	ALARM OCCURRED (Time) FORMAT: 12:00 AM/PM	
REPORTED BY:	ALARM TYPE	
	Personal H2S Alarm	<input type="radio"/>
REPORTED TO:	Fixed H2S Alarm	<input type="radio"/>

EVENT TYPE:	
Describe the Activity and specific location when H2S Alarm Activated <i>(e.g. blinding RPV-3510 Recycle Gas Suct K/O in the Reaction Section)</i>	
Immediate Actions Taken	

Was this activity performed in supplied air?	<input type="radio"/> No	<input type="radio"/> Yes	
Is this a routine activity?	<input type="radio"/> No	<input type="radio"/> Yes	

How long did the alarm sound?	
Was H2S odor present?	
Were any symptoms of H2S exposure experienced? (irritation, nausea, headache)	
Was medical treatment sought?	
Peak Reading (ppm)	

ALARM PREVENTION
What pre-event actions might have been taken to prevent this alarm from occurring? Please give a short description

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8.0 PERSONAL H₂S MONITOR ASSIGNMENT/REPLACEMENT FORM

Request for H₂S monitor: Visitor Replacement Monitor Temporary Loaner* New

Employee/Visitor Name: _____ Date: _____

Employee #: _____ Company/Agency: _____

Job Title: _____ Department/Unit: _____

Supervisor: _____ Phone #: () - _____

Marathon Representative/Escort: _____

Email: _____

Work Order #: (required for replacement and loaner monitors) _____

Reason for Request: Lost Forgot Error No Power New employee**/assignment

Please describe what happened to your previous monitor: _____

Length of Issuance: Permanent 1 -3 Days Temporary (1 shift) Other _____

Serial Number of Monitor Assigned:

* Loaner monitors must be returned to Safety Issue within 72 hours of temporary issuance, or price of the loaner monitor will be charged to your work order number.

**Health approval and training for operation and use of the monitor is required prior to issuance.

I have received and reviewed Hydrogen Sulfide Exposure Prevention Program (HSS-404) which contains instructions for responding to alarming personal H₂S monitors.

Employee/Visitor Signature: _____

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H2S Procedure Change Log

Summary of Changes	Changes Completed by:	Approved by:	Date
<p>LAR procedures (SAF016 and FS 450) were integrated to create HSS-404.</p> <p>A "Contents" table has been added to help direct procedural inquiries more directly to the appropriate section and page.</p> <p>The "Definitions" section has been expanded to include terminology from the corporate standard TSHS-204.</p> <p>Section 4.0 has been updated to specify responsibilities for alarm reporting to all personnel</p> <p>Section 5.0 updated to include the approved personal H2S monitor for LAR personnel, removal of placement of H2S monitors on hard hats without medical exemption, and specific alarm reporting instructions.</p> <p>Appendix now includes:</p> <ul style="list-style-type: none"> - Updated Exposure Concentrations and Health Effects table - Wilmington Process Streams Containing Greater than 0.1% H2S table - Updated Job Tasks and Respiratory Protection Requirements table - Updated Alarm Event Flowchart - Updated H2S Alarm Notification Report - Updated Personal H2S Monitor Assignment/Replacement Form 	Pearl Lee	Sharon Callahan	8/3/2016
Updated 5.5.b.2.i. to clarify reporting requirements for Supplied Air jobs	Pearl Lee	Sharon Callahan	4/13/2017
Modified Figure 1 for clarity	Pearl Lee	Sharon Callahan	10/23/2017
<ul style="list-style-type: none"> - Addition of requirements outlined in MPC RSP 1700 - MPC standards and guidelines added as reference - Hard hat allowance and specified breathing zone distance - Changed frequency of document review from 3yr to annually - Removal of monitor exemptions at loading racks and lab - Specified alarm calibration frequency - Changes to alarm reporting and medical follow up requirements - OSHA Maximum Peak alarm requirements - Update to Alarm Flow Chart - Update to H2S Alarm Notification Report 	Pearl Lee	Sharon Callahan	2/4/2019
<p>Corrected the following:</p> <ul style="list-style-type: none"> • Corrected Breathing zone definition • Removed Andeavor reference in 5.2.c • Removed Watson Cogeneration from monitor exemption under 5.2.d.6 • Corrected monitor placement distance under 5.2.2.1 	Sharon Callahan	Sharon Callahan	9/23/19

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<p><u>Hydrogen Sulfide Exposure Prevention</u> <u>Prevention</u> <u>00004</u></p>		<p>Page 28 of 29</p>	



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Summary of Changes	Changes Completed by:	Approved by:	Date
<ul style="list-style-type: none"> Corrected Table no. under 5.4.a and deleted 5.4.b since it is covered in 5.4.a. 			
Added the following: <ul style="list-style-type: none"> Added wording for the availability of an amplifier attachment to increase audible alarm level to section 5.2.1 Monitor Requirements. Added wording to ensure visual alarm can be seen when working in a high noise area to section 5.2.2 Monitor placement. 	Sharon Callahan	Sharon Callahan/ P&P	2/5/20

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