

		<b>SAFE WORK INSTRUCTION</b>			<b>HS-SWI-046</b>	
SALT LAKE REFINERY		<b>Respiratory Protection</b>				
RESPONSIBLE DEPT.		CONTENT STEWARD			APPROVED BY	
Health & Safety		Health & Safety Superintendent Anne Alder			HSE Manager Will Snarr	
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## INTRODUCTION

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### Purpose

The purpose of this policy is to prevent occupational respiratory illness by establishing respiratory protection procedures that protect employees against harmful exposure to airborne contaminants encountered during normal and emergency work activities, and where engineering controls or administrative controls have not reduced potential exposures to acceptable levels.

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### Scope

This instruction applies to Tesoro and Contractor personnel.

This safe work instruction provides specific information in the following areas:

- Training
- Proper selection of respirators
- Proper usage of respirators
- Emergency usage
- Cartridge change out
- Proper cleaning and storage

### References

#### Federal

- NIOSH 42 CFR Part 84 Approval of Respiratory Protective Devices
- OSHA 29 CFR 1910.134 Respiratory Protection
- OSHA 3352-02 Assigned Protection Factors for the Revised Respiratory Protection Standard

#### Tesoro

- TSHG-002: *Hydrogen Sulfide Detection Guidance Document*, Section 10
- TSHG-004: *Mercury in Petroleum Refineries Guidance Document*, Section 4.11.A.
- TSHG-008: *Nickel Carbonyl Guidance Document*, Section 4.4.
- TSHG-010: *Abrasive Blasting and Hydroblasting Guidance Document*, Section 4.6.
- TSHG-011: *Working with Lead-Containing Materials*, Section 4.3.J.
- TSHG-012: *Health Precautions for Welding, Grinding and Torch Cutting*, Section 4.7 and Appendix A.
- TSHG-013: *Naturally Occurring Radioactive Materials (NORM)*, Section 4.8.A.

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- TSHG-016: *Benzene Guidance Document*, Section 4.8.
- TSHG-017: *Health Protection with Cooling Towers*, Section 4.11.D.
- TSHG-018: *Breathing Air*
- TSHG-019: *Nitrogen Safe Handling*, Sections 4.2 - 4.4, 4.9 and Appendix A.
- TSHS-003: *Medical Surveillance Section*, 4.3 and Appendices B – H.
- TSHS-007: *Inert Entry*, Section 5.4
- TSHS-010: *Hazard Assessments and Additional PPE*, Section 4.7 and Appendix C.

## **ROLES AND RESPONSIBILITIES**

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**Safety and Health Department (Industrial Hygienist or Designee)**

The refinery industrial hygienist or designee is responsible for implementing the contents of this program. These responsibilities include:

- Assigning the role of Respiratory Protection Program Administrator to one responsible individual.
- Determine if routine job assignments or work tasks require respiratory protection.
- Determine which process areas or work tasks require the use of respiratory protection.
- Determine which process areas must be posted as regulated areas with respiratory protection required for entry.
- Assisting with determining appropriate respiratory protection for unusual work tasks or potential exposures.
- Determining the appropriate level of respiratory protection. This is accomplished by documenting the potential respiratory hazards, including the physical state and form, and assessing the level of exposure.
- Approving an assortment of respirators that provide adequate protection against potential airborne contaminants in each work area.
- Evaluating this program annually to determine if it is effectively protecting employees from respiratory hazards.

**Medical Department**

The Medical Department is responsible for:

- Implementing the respirator medical surveillance requirements as outlined in this SWI, Tesoro policy TSHS-003 Medical Surveillance Standard, and in 20 CFR 1910.134(e).

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- Conducting (or reviewing) respirator fit testing.
- Notifying the employee and their supervisor of the medical clearance determination.

### Employees

Employees are responsible for:

- Wearing appropriate respiratory protection when required based on the determination made by the Safety and Health department for the work area or process being conducted.
- Using respiratory protection properly in accordance with the manufacturer's instructions and Tesoro training.
- Performing positive and negative seal checks (as appropriate) each time a respirator is donned.
- Inspecting the respirator before, and cleaning it and after each use.
- Properly storing the respirator when not in use.
- Immediately reporting any problems associated with respirator use.

### Supervisor

Supervisors are responsible for:

- Ensuring that employees and contractors wear appropriate respirators based on the determination made by the Safety and Health department for the work area or process being conducted.
- Ensuring that any employee who wears a respirator has been properly trained, medically cleared, and fit-tested.
- Ensuring that employees properly maintain and store respiratory protection.
- Contacting the Health and Safety Department for assistance when unusual work tasks or circumstances arise, or when there is a question about respiratory protection being used.

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**Warehouse staff** Warehouse staff are responsible for ensuring an adequate supply of respiratory protective equipment including filters and cartridges, parts, and sanitizers for routine and unusual work activities.

**Contractors** Contractors are responsible for complying with this SWI and all appropriate regulatory requirements outlined in 29 CFR 1910.134. Contractors must:

- Have an established and compliant respiratory protection plan and provide employees who have completed all required training, fit-testing, and medical evaluation for the respiratory protection being used.
- Provide appropriate respiratory protection for the hazards and concentrations to which employees may be exposed.

Coordinate with the Tesoro Health and Safety Department to ensure that the correct hazards and conditions are anticipated prior to starting work.

**Engineering** Engineering is responsible for specifying or requiring new equipment that controls or eliminates worker exposure to airborne hazardous materials, whenever feasible.

## DEFINITIONS

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<b>Airline respirator</b>	A respirator connected to a stationary source of compressed breathing air by a hose. Breathing air is delivered continuously in sufficient volume to meet the wearer's breathing requirements. The air supply hose length cannot exceed 300 feet. The airline is attached to the wearer by belt and can be detached rapidly in an emergency. A flow control valve or orifice is provided to govern the rate of airflow to the wearer. Exhaled air passes to the ambient atmosphere through a valve(s) in a face piece, hood, or suit.
<b>Air-purifying respirator (APR)</b>	A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants as ambient air passes through the air-purifying element.
<b>Air-supplying respirator</b>	A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, or with breathing air from a compressor. This type of respirator includes air-line respirators, supplied-air respirators and self-contained breathing apparatus units.

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- Assigned Protection Factor (APF)** The level of respiratory protection that a respirator or class of respirators is designated by OSHA to provide to employees when properly worn. The actual protection factor measured by quantitative fit testing is called a fit factor and is expected to be higher than the assigned protection factor.
- Canister or Cartridge** Container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.
- Filtering Face piece Respirator** A negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium. **Note:** Currently, these respirators cannot be quantitatively fitted.
- Grade D Breathing Air** Compressed or supplied air that meets specifications detailed in Compressed Gas Association Commodity Specification for Air, G-7.1-2004, which include:
- |                              |                                  |
|------------------------------|----------------------------------|
| Oxygen                       | 19.5-23.5%                       |
| Carbon Monoxide              | No more than 10 ppm              |
| Carbon Dioxide               | No more than 1000 ppm            |
| Oil (Condensed Hydrocarbons) | No more than 5 mg/m <sup>3</sup> |
| Odor                         | No noticeable odor               |
- Demand-Respirator** A supplied air respirator that provides face piece air pressure that is positive during exhalation and negative during inhalation, relative to air pressure outside of the face piece. Should not be confused with a pressure-demand respirator. Demand supplied air respirators should be considered obsolete.
- ESLI End of Service Life Indicator** A visible or audible means of warning when a cartridge or other air-purifying element is no longer able to protect the respirator wearer. ESLIs may be active such as a buzzer, or passive such as a label that changes color.
- Exposure Assessment** A qualitative or quantitative process for determining the degree and extent of employee exposure to a potentially harmful agent, especially an airborne agent for purposes of this guidance document.
- Fit Factor** A quantitative estimate of the fit of a particular respirator to a specific individual. Typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.
- Fit Test** The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

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**HEPA High efficiency particulate filter** A filter that is at least 99.97% efficient in removing mono-dispersed particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR Part 84 particulate filters are the N100, R100, and P100 filters

**IDLH (Immediately Dangerous to Life and Health)** The current NIOSH definition is “the lowest concentration that poses a threat of exposure to airborne contaminants likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment”.

**Maximum use concentration (MUC)** The maximum use concentration is calculated for a type of respirator by multiplying the contaminant 8-hour PEL times the respirator’s assigned protection factor. If the IDLH concentration for the contaminant is lower than the calculated maximum use concentration, only an SCBA or an air line respirator with 5-minute escape bottle can be used to enter or work in that concentration.

**Negative Pressure Respirator** A respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator

**Oxygen Deficient Atmosphere** An atmosphere with oxygen content below 19.5% by volume.

**Permissible Exposure Limit or PEL** An exposure limit that is published and enforced by OSHA as a legal standard. PELs may be either an 8-hour time-weighted-average exposure limit, a 15-minute short term exposure limit (STEL), or a ceiling limit. The PELs are found in Tables Z-1, Z-2, or Z-3 of OSHA 1910.1000.

**Powered Air Purifying Respirator** An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

**Positive Pressure Respirator** A term without a NIOSH-recognized definition. Is generally understood to have the same definition as “pressure-demand”.

**Pressure-Demand Respirator** A supplied air respirator which provides air pressure inside the face piece that is greater than air pressure outside the face piece during both inhalation and exhalation. Only pressure-demand supplied air respirators should currently be in use. Demand supplied air respirators should be considered obsolete.

**PPM** Parts per million; a unit for measuring the concentration of a gas or vapor in air as parts by volume of the gas or vapor in a million parts of air.

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**QLFT**

**Qualitative Fit Test**

A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's subjective response to the test agent.

**QNFT**

**Quantitative Fit Test**

An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

**Self-contained breathing apparatus (SCBA)**

Positive pressure, air-supplying respirator with the breathing air source supplied from a compressed gas cylinder carried by the user. Normally equipped with a full face piece, but some 5-minute escape respirators may have only a mouthpiece for escape purposes.

**Service Life**

The period of time that a respirator, cartridge filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

**Supplied-air respirator (SAR)**

Positive pressure, air-supplying respirator that provides breathing air to the respirator wearer through an airline (hose) from by breathing air cylinders, from a breathing air compressor, or from an attached breathing air cylinder.

## PRACTICES

**Respiratory Hazards and Protective Equipment**

It is the responsibility of the Safety Department and area Supervisors to ensure that the correct respiratory protection is provided at no cost to employees and used when appropriate.

Recommendations for respiratory protection are provided in Tesoro guidance documents and standards for many types of work activities and hazardous materials. These documents include:

- Abrasive blasting, TSHG-010: *Abrasive Blasting and Hydroblasting Guidance Document*, Section 4.6.
- Benzene, TSHG-016: *Benzene Guidance Document*, Section 4.8
- Cooling towers, TSHG-017: *Health protection with Cooling Towers*, Section 4.11.D.
- Hydrogen sulfide, TSHG-002: *Hydrogen Sulfide Detection Guidance*
- Inert entry, TSHG-007: *Inert Entry*, Section 5.4.
- Inorganic lead, TSHG-011: *Working with Lead-Containing Materials*, Section 4.3.J.

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- For Mercury, TSHG-004: *Mercury in Petroleum Refineries Guidance Document*, Section 4.11.A.
- Nickel carbonyl, TSHG-008: *Nickel Carbonyl Guidance Document*, Section 4.4.
- NORM, TSHG-013: *Naturally Occurring Radioactive Materials (NORM)*, Section 4.8.A.
- Oxygen deficiency caused by inert gases, TSHG-019: *Nitrogen Safe Handling*, Sections 4.2, 4.3, 4.4, 4.9, and Appendix A.
- Welding and Torch Cutting, TSHG-012: *Health Protection for Welding, Grinding and Torch Cutting*.

Respiratory protection for other chemicals and materials are provided in TSHS-010: Hazard Assessments and Additional PPE, Appendix A. In addition, recommended types of respiratory protection and example cartridge change-out schedules are provided in Appendix A of this SWI.

## **Air Purifying Respirators (APR'S)**

APRs are appropriate when working with known concentrations of a known group of contaminants. They are not appropriate for work in IDLH or potentially IDLH atmospheres, or when concentrations of contaminant exceed the maximum use concentration determined by multiplying the exposure limit by the respirator's assigned protection factor. No respirator can be worn without appropriate training, fit-testing, and medical evaluation in accordance with this SWI.

### **Precautions**

- The contaminants present and their concentrations must be known.
- The APR and cartridges must be approved for use against the contaminants present.
- Respirator cartridges must be changed-out according to a change-out schedule as outlined in Appendix A in this SWI and the manufacturer's guidance.
- The date, time, and user's initials must be marked on each cartridge prior to use so that the change-out schedule can be monitored.
- The maximum use concentration must be determined by multiplying the exposure limit by the respirator's assigned protection factor.
- APR's are not appropriate for IDLH conditions.
- The oxygen concentration must remain between 19.5 and 23.5%. Concentrations outside of this range constitute IDLH conditions.

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- Employees must leave the contaminated area and notify their supervisor and Health and Safety immediately in case of the following:
  - Detection of leakage or breakthrough into the respirator
  - Malfunction of the respirator
  - Illness such as: dizziness, nausea, weakness, difficulty breathing, coughing, sneezing, itching, fever, or chills.

### **Half-Mask Cartridge APRs and Filtering Face piece Respirators**

Half-mask cartridge APRs are equipped with two inhalation and one exhalation valve. Filter cartridges are installed over each inhalation valve to remove the contaminants of concern as the wearer inhales. They are worn over the bridge of the nose, around the mouth, and down below the chin.

- Half-mask cartridge APR's and filtering face piece respirators have an assigned protection factor of 10.
- Tesoro Salt Lake City does not offer half-mask or filtering face piece respirators to its employees, opting instead for the full-face APR, based typical task hazards and suitability for emergency situations.
- The respirator must be fit-tested on the employee prior to use to ensure a proper passing seal.
- The employee must conduct a user seal-check each time the respirator is donned.
- Respirator cartridges must be changed-out according to a change-out schedule as outlined in Appendix A in this SWI and the manufacturer's guidance.
- If a contractor allows the voluntary use of filtering face piece respirators, the employer must follow the appropriate provisions in 29 CFR1910.134(c)(2). The employer must determine that such respirator use will not in itself create a hazard (i.e., by ensuring that masks are not used if dirty or contaminated and that their use does not interfere with the employee's ability to work safely). The employer also must provide the information in 29CFR1910.134, Appendix D to each voluntary wearer.

### **Full-face APRs**

Full-face APRs are equipped with two inhalation and one exhalation valve. Filter cartridges are installed over each inhalation valve to remove the contaminants of

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concern as the wearer inhales. Full-face respirators offer eye protection in addition to respiratory protection. They are worn over the perimeter of the face from the forehead down below the chin.

- Full-face APR's have an assigned protection factor of 10 or 50.
- A qualitative fit-test can be performed to achieve an assigned protection factor of 10. In order to achieve an assigned protection factor of 50, quantitative fit-testing must be performed.
- Tesoro Salt Lake City offers several brands of full-face respirators in small and medium/large sizes. If an employee does not achieve an acceptable fit on any of the stocked respirators, other commercially available respirators will be provided, if they provide an acceptable fit.
- The respirator must be fit-tested on the employee prior to use to ensure a proper passing seal.
- The employee must conduct a user seal-check each time the respirator is donned.
- Respirator cartridges must be changed-out according to a change-out schedule as outlined in Appendix A in this SWI and the manufacturer's guidance.

## Supplied Air Respirators

Supplied air respirators (SARs) are used when work must be conducted in atmospheres with concentrations of airborne hazards exceeding the maximum use concentration of an APR and in IDLH atmospheres. There are generally two types of SARs used at Tesoro Salt Lake City, including airline and self-contained breathing apparatus (SCBA). Airline respirators may be used with 5-minute emergency escape bottles or packs. No respirator can be worn without appropriate training, fit-testing, and medical evaluation in accordance with this SWI.

### Precautions

- Air supplied to SARs, regardless of whether in an airline or compressed air tank, must meet Grade D breathing air requirements. These requirements are outlined in TSHG-018: Breathing Air.
- SARs must be used in pressure-demand mode, in which a slight positive pressure is always maintained inside the respirator.
- A 5-minute escape bottle must be equipped with airline respirators when

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work is conducted in an IDLH atmosphere.

- SARs require more training and routine practice than APRs, to ensure employees remain competent in their use.

### Self-Contained Breathing Apparatus

A self-contained breathing apparatus (SCBA) is an air-supplying respirator with the breathing air source designed to be carried by the wearer.

- This respirator type includes a full-face mask, breathing air cylinder, and a regulator to control airflow.
- SCBAs typically provide breathing air cylinders with nominal 30 minute or 60 minute capacities. The actual time duration that an SCBA will provide breathing air will vary with the user.

### Airline Respirators

An airline respirator provides breathing air from a remote source such as an air compressor or bank of cascaded breathing air cylinders.

- With some airline respirators, a nominal 5-minute escape breathing air bottle may be attached to the respirator harness. This 5-minute escape bottle is not to be opened unless needed for escape in the event that the primary breathing air source is interrupted while the respirator is in use.
- If the hose of an airline respirator could become kinked, cut or disconnected during work in a hazardous atmosphere, the airline respirator should be equipped with a 5-minute escape bottle.
- The length of the breathing air hose cannot exceed 300 feet.
- Breathing air sources for air-line respirators can be fixed or portable.
- Refineries may provide air—line breathing air systems to allow Operators to remain inside control rooms in the event of an emergency.

### Five-minute Escape Pack Respirators

Five-minute escape pack respirators are air-supplying respirators designed to give the respirator wearer a nominal 5 minute supply of air to escape from a toxic atmosphere in the event of a chemical release.

- Five-minute escape packs may be located in control rooms or other occupied locations where a toxic atmosphere might unexpectedly develop.

### Abrasive Blasting Respirators

Contractors are permitted to use abrasive blasting respirators (Type CE respirators)

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as appropriate. Abrasive blasting respirators are continuous flow, positive pressure respirators that can be either half- or full-face masks, or loose fitting hoods/helmets. Air is to be supplied at a constant flow rate of 4 cubic feet per minute (cfm) for a tight fitting face piece and 6 cfm for a loose fitting hood/helmet. Loose fitting Type CE respirators such as blaster’s hoods are permitted by OSHA to be worn for exposures up to 25 times the PEL for hazardous materials including lead.

### **Low-Pressure Carted Bottle Breathing Equipment**

- Bottled breathing air equipment is to be used for emergency work of long duration and regular scheduled maintenance work. Personnel required to use respiratory protection, including carted bottle breathing equipment, must also have been trained and medically evaluated prior to use.
- This work requires that a “Bottle Watch” be present for the entirety of the job. A qualified bottle watch is required to complete Tesoro bottle watch training.
- Carted bottle breathing equipment is available from the Maintenance Department. Ready to use equipment will be denoted with a blue tag affixed to the cart box in such a manner that opening the box requires the seal to be broken.
- Equipment shall be transported with bottle caps in place. Hoses should not be allowed to drag on the ground during transport and the hose ends should be hooked together to prevent dirt and water entry.
- A record of current fit test must be available for each respirator checked out so that the proper size is issued for the person using the respirators.
- To establish a fresh air job site using carted bottle breathing air:
  - Place cart upwind and a safe distance away from the job site.
  - Barricade the area to preclude entry. All personnel who are unprotected shall remain outside of the hazard zone.
  - Bottle watch must remain alert at all times.
- To operate carted bottle breathing equipment:
  - Ensure each bottle has a Breathing Air Quality label affixed.
  - Ensure that the Tesoro tag on the cart has not been broken. In addition, a silver tag shall be affixed to the cart denoting the date inspected, initials of inspector and the contents of the cart. The cart contents include:

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- Pelican case with Surviv-air respirator, regulator, and 5-minute escape pack (3)
  - Y manifold (2) (one 2-way and one 3-way)
  - Wrench (2)
  - Regulator (1)
- Remove caps from bottles and connect regulator with gauges to one bottle. Gauge from 0 - 600 regulates airflow. Gauge from 0 - 4000 denotes bottle pressure.
- Connect flexible metal hose from pressure reducing regulator to the other bottle.
- Check the pressure on each bottle with the regulator gauge by slowly opening each bottle separately until maximum pressure is established. (Note: Close the first bottle before opening the second bottle.) If the second bottles content pressure is lower, pressure on the gauge will bleed down to the lower pressure. When the system is in use, only one bottle is to be used at a time, the second bottle should remain closed. Use the bottle with the lowest pressure first. Pressure of a full bottle is 2400 psi.
- Adjust air delivery rate. Air systems being utilized by one or more persons should be operated at 100 psi.
- Connect the 2-way or 3-way manifold to the regulator. Connect hose(s) from the side of the cart to the manifold. Expel a small amount of air to clear moisture from the line.
- Hook quick-connect to hose line.
- Ensure 5-minute escape pack gauge indicates a full bottle. Open shoulder straps and belt to full position. Don on 5-minute escape pack. Tighten shoulder straps. Fasten and tighten belt.
- Connect facemask to regulator.
- Attach harness ensemble to quick-connect.
- Check to ensure that masks and hoses are in good condition, and that all couplings are made up properly. Hanson coupling sleeves must be aligned to make a connection or disconnection. However the coupling should be rotated so that the notch on the sleeve does not align with the dot on the body during use.
- Masks must be put on and adjusted to the face prior to entering the work

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area. A negative and positive fit check must be performed. The mask is adjusted by placing chin into mask and pulling straps taut, first the chin straps, then side straps and finally at the top.

- The regulator is used in a PRESSURE DEMAND mode.
  - On PRESSURE DEMAND, the regulator maintains a slight positive pressure in the face piece. After slight positive pressure is established, air is fed to the face piece only upon inhalation (demand) of the wearer to maintain the positive pressure. The airflow ceases upon exhalation. It is noted that when the regulator is on PRESSURE DEMAND the wearer will notice a slight pressure when exhaling.
- The "Safety Watch" or "Bottle Watch" shall be instructed to keep constant check on the bottle pressure. When the bottle which is in service depressurizes to 500 psi, the other bottle is to be put into service. \*To do this the following steps are taken:
  - Tell the workers that the bottles must be switched.
  - Close the valve on the first bottle, and immediately open the valve on the second bottle.
  - NOTE: There will be enough air in the system for the users while the bottles are being switched.
- If it becomes necessary to put fresh bottles on the cart, the use of the fresh air equipment will have to be halted until the change has been completed. Additionally bottles of breathing air can be obtained from the firehouse.
- On completion of the job:
  - Remove mask by depressing the small black switch located on mask's regulator. This will prevent the expulsion of air through mask until next breath through mask is taken. Shut off air at the bottles.
  - Disconnect components and remove any excess dirt, oil, etc. before replacing in or on proper storage lines or reels. DO NOT put masks in plastic bags to prevent further use prior to cleaning. Place masks, regulator and escape bottle in the Pelican case.
  - Replace caps on bottles - bottle caps must always be on the bottle when they are not in use. Empty bottles should be labeled.
  - After coiling up air hose on cart reels, couple ends together to keep

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hose and couples free of foreign material.

- Notify your Supervisor that the equipment is ready to be returned to the firehouse.

**Blinding for H2S**

Prior to opening lines or equipment, gases, oils or chemicals must be drained, washed, steamed or purged with inert gas. No respiratory protection is needed for blinding when the H2S concentration of the stream is less than 10 ppm. Fresh air will be used for initial blinding on lines and / or equipment that normally contains H2S concentrations above 10 ppm.

No respiratory protection is needed if the following conditions can be met;

- Isolation is located within 6 feet of each other
- Low point bleed is verified 0 ppm H2S

**Blinding for Benzene**

Prior to opening lines or equipment, gases, oils or chemicals must be drained, washed, steamed or purged with inert gas. No respiratory protection is needed for blinding when the benzene concentration of the stream is less than 1 ppm. Full face respirator will be worn for initial blinding when the benzene concentration of the stream is above 1 ppm and below 10 ppm. Fresh air will be required when the benzene is above 10 ppm.

No respiratory protection is needed if the following conditions can be met;

- Isolation is located within 6 feet of each other
- Low point bleed is verified 0 ppm benzene

**Protection Factors and Maximum Use Concentrations**

OSHA has published assigned protection factors for the primary classes of respiratory protection. The assigned protection factors are used to evaluate the level of protection a given type of respirator provides. The assigned protection factors are provided in the table below.

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Table 1. -- Assigned Protection Factors<sup>5</sup>

Type of respirator	Quarter mask	Half mask	Full face piece	Helmet/hood	Loose-fitting face piece
1. Air-Purifying Respirator	5	<sup>3</sup> 10	50	.....	.....
2. Powered Air-Purifying Respirator (PAPR)	.....	50	1,000	<sup>4</sup> 25/1,000	25
3. Supplied-Air Respirator (SAR) or Airline Respirator					
• Demand mode	.....	10	50	.....	.....
• Continuous flow mode	.....	50	1,000	25/1,000	25
• Pressure-demand or other positive-pressure mode	.....	50	1,000	.....	.....
4. Self-Contained Breathing Apparatus (SCBA)					
• Demand mode	.....	10	50	50	.....
• Pressure-demand or other positive-pressure mode (e.g., open/closed circuit)	.....	.....	10,000	10,000	.....

Source: [29 CFR 19010.134](#)

In order to calculate the maximum use concentration (MUC), the assigned protection factor is multiplied by the applicable exposure limit. The resulting number is the maximum concentration the worker is allowed to be exposed to while wearing the corresponding respirator.

For example: the OSHA PEL for benzene is 1 part per million (ppm). A half-face respirator equipped with organic vapor cartridges has an assigned protection factor of 10. The maximum use concentration would therefore be 10 ppm. The equation can be summarized as:

$$APF * PEL = MUC$$

In order to determine if a given respirator is appropriate, the expected concentration of the contaminant in question must be known. The concentration can be determined based on past worker exposure assessments or real-time monitoring using gas detection equipment.

- The Health and Safety Department will determine the expected contaminant concentrations and appropriate respiratory protection for a given task.
- APRs may not be used if the maximum use concentration exceeds the IDLH

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concentration, because they are not appropriate for IDLH atmospheres.

- Other health effects (such as eye irritation) must also be taken into account.
- The change-out schedule must be determined based on the expected contaminant concentration and other working conditions. The change-out schedule will be calculated using the respirator manufacturer’s calculator. The example respirator selection and cartridge change-out schedule provided in Appendix A can be used as a guide in addition to the manufacturer’s calculator.

### Respiratory Protection for Emergencies

Emergency situations may generate unknown concentrations of contaminants and IDLH conditions. If the concentration of any contaminant is unknown, it must be assumed to be IDLH until determined otherwise by the Health and Safety Department.

#### Precautions

- Only employees authorized and trained to use and equipped with SCBAs are allowed to enter IDLH conditions with unknown concentrations of contaminants.
- If concentrations are known and an assigned protection factor of 1000 provides adequate protection, then a full-face airline respirator with a five-minute emergency air supply tank may be used.
- The Health and Safety Department may downgrade the level of protection required for an emergency response scenario if the concentration of the contaminants of concern is determined.
- At least one employee must be located outside of the emergency area for each employee who enters the IDLH work area.
- Each outside employee must be trained and equipped to provide emergency rescue in the IDLH environment, including:
  - An SCBA.
  - Retrieval equipment appropriate to provide rescue to employees working in the rescue environment.
- The Health and Safety Department must be notified prior to an emergency rescue entry and will provide assistance.

### Respirator

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## Cartridge Change-Out Schedule

The life of a respirator cartridge is dependent on many factors. Some of these factors include contaminant concentration, temperature and relative humidity, and breathing rate. If a cartridge becomes overloaded, the contaminant breakthrough can occur, exposing the user to contaminants. In order to prevent breakthrough, a cartridge change-out schedule has been developed and is provided at Appendix A.

### Precautions

- Respirator cartridges are only protective against specific contaminants.
- Respirator cartridges are color-coded to indicate the types of contaminants for which they are effective.

### Cartridge Change-Out Schedule

- The maximum allowed usage time for any cartridge is 8 hours, unless an alternative change out schedule has been developed in accordance with the manufacturer's requirements.
- Employees must leave the contaminated area prior to changing out cartridges.
- The used cartridges must immediately be disposed of in an appropriate waste receptacle.
- The user must conduct a user seal check to ensure the cartridges have been installed correctly prior to entering the contaminated area.

## Respirator Selection

The Health and Safety Department selects appropriate respiratory protection based on the expected contaminants, the concentrations of the contaminants, and other working conditions. The following are considered in the evaluation and selection of appropriate respiratory protection.

- The contaminants of concern,
- The contaminant concentrations,
- The physical state of the contaminants,
- The permissible exposure limits or other applicable exposure limits for the contaminants,
- Oxygen level,
- The relative risk of potential emergencies,
- The appropriate type of respirator relative to assigned protection factors

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and maximum use concentrations,

- The duration of exposure,
- Other stress factors in the work environment,
- The need for eye and face protection,
- Employee comfort, and
- Limitations of the respirator.

#### **Respiratory Protection Available**

- Respiratory protection is available from the Storehouse or provided as issued equipment.
- The following respirators are available to Tesoro Salt Lake City employees:
  - Half face
  - Full face
  - SAR
  - SCBA
- Employees who are required to wear APRs, will be assigned their own respirator for their exclusive use.

#### **Respirator Cartridge Color Coding**

Respirator filter cartridges are color-coded based on the chemicals or types of chemicals for which they provide protection. The colors are designated in ANSI/AIHA Z88.7-2001. The colors include the following:

- Purple: Oil-proof high efficiency particulate air (HEPA) filters. Pink is an unauthorized substitution used by some manufacturers.
- Olive: vapor and gas combinations not listed in the color standard.
- White: Acid gases.
- Yellow: Acid gas and organic vapors.
- Orange: Unauthorized use for mercury vapor and chlorine gas. Oil-resistant and oil-proof other than P-100.
- Black: Organic vapors.
- Green: Ammonia gas.

Colors may be combined if a cartridge is effective against multiple contaminants. The user should not rely on color codes alone, and should always read the label to ensure the cartridge is effective for the contaminants in question.

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## Respirator Inspection and Repair

Respiratory protection must be properly maintained to ensure it is effective. The manufacturer's recommendations must be followed when inspecting and repairing any respirator.

### Air Purifying Respirators

- APRs must be inspected by the wearer before each use and during cleaning after use. They must be inspected and cleaned monthly if they are not routinely used.
- Monthly inspections must be documented with the following:
  - Date of inspection,
  - Respirator identification number,
  - Respirator name,
  - Inspector name,
  - Inspection findings, and
  - Any required remedial action, as needed.

### SCBAs

Routine use SCBAs are maintained in at the Fire Department and issued to trained individuals for routine work. Emergency Respirators are positioned at key locations in the refinery, in protected containers. SCBAs are inspected prior to routine use by the wearer and monthly by a trained individual (operators, Fire Inspector, mechanics, storehouse staff).

Prior-to-use inspections are conducted by the wearer (Note: Prior-to-use inspection is not required for emergency use of SCBAs).

Prior-to-use and monthly inspections include:

- Air cylinders shall be maintained in a fully charged state and shall be recharged when the pressure falls to 90% of the manufacturer's recommended pressure level.
- A check for tightness of connections,
- Pliability and proper shape of elastomeric parts,
- Cracked or damaged face shield,
- For condition of the respiratory inlet covering, head harness, valves, connecting tubes, harness assemblies, hoses, filters, cartridges, canisters, end-of-service-life indicator, and shelf life date(s); and

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- Each rubber or other elastic part shall be inspected for pliability and signs of deterioration.
- Any respirator found to be defective must be taken out of service immediately.
- Any repairs must be conducted by a manufacturer trained and qualified technician in accordance with the manufacturer’s directions, and using only genuine parts specific to the respirator being repaired.

Monthly inspections must be documented (currently by electronic means) with the following information:

- The date the inspection was performed;
- The name or (signature) of the person who made the inspection;
- The findings, required remedial action(s); and
- A serial number or other means of identifying the inspected respirator;

Annual inspection and testing is performed by a contracted professional and includes all the items of monthly testing and in addition:

- Flow testing of mask and bottles; and
- For the proper function of regulators, alarms, and other warning systems.

## Respirator Maintenance and Storage

### Cleaning

Respirators must be cleaned on a routine basis to prevent microbial contamination, chemical degradation, or other damage. Each manufacturer publishes recommendations outlining the proper methods and materials to be used for cleaning, which must be followed. Using incompatible cleaners or cleaning methods may damage the respirator.

### Storage

Respirators must be stored properly to prevent microbial contamination, chemical or UV degradation, or other damage. Each manufacturer publishes recommendations outlining the proper methods for storage, which must be followed. General best-practice storage requirements include:

- Clean and inspect the respirator for damage after each use and before placing into storage.

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- Ensure respirator is completely dry before storage.
- To prevent condensation and microbial growth, do not store respirators in an air-tight container.
- Store in a temperature-controlled environment, away from direct sunlight and exposure to airborne contaminants.
- Ensure the face piece is not deformed in any way. Distorting the face piece during storage will cause permanent irreparable damage.

## Medical Surveillance

Details regarding medical surveillance are discussed in TSHS-003: Medical Surveillance Standard. All employees who are required to wear a respirator must participate in a medical evaluation to determine if they are medically able to wear the respiratory protection. The medical evaluation must be conducted prior to fit testing or wearing a respirator in the workplace.

A determination of the employee's ability to wear a respirator while working will be made initially upon employment. Annual medical examinations are not required. However, Tesoro has established a medical evaluation frequency of five years with the following exceptions:

- Annual for employees exposed to sensitizers
- Upon notification and annual for employees with pulmonary diseases
- Employees participating on Emergency Response Teams

To be medically cleared for respirator use, the employee will complete the OSHA mandated medical evaluation questionnaire that is administered confidentially by Health Services. The medical evaluation questionnaire is reviewed by the designated physician or licensed health care professional (PLHCP; this is the Refinery Medical Department or company physician).

- Supplemental information such as the type and weight of the respirator, expected physical work levels, and additional PPE used must be provide to the PLHCP and considered in the medical evaluation.

Upon review of the questionnaire and if they determine it is necessary, the employee will receive an examination. The physician will then either approve or disapprove the employee's ability to wear a respirator. A written approval will be given by a Physician's Clearance Letter. The letter must include only the following

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information:

- A written recommendation regarding the employee’s ability to wear a respirator.
- A description of any limitations associated with respirator use.
- The need for any follow-up evaluations.
- Verification that the PLHCP has provided the employee with a copy of the written recommendations furnished to Tesoro.
- The employee is allowed to discuss the questionnaire with the PLHCP as needed.

The PLHCP may direct the use of PAPRs instead of negative pressure respirators. Copies of the medical evaluation and questionnaire will be kept in the employee’s medical file in accordance with 29 CFR 1910.1020. Sample copies of the physician’s clearance letter and medical questionnaire are available from Health Services.

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## Fit Testing

Employees using a tight-fitting face piece respirator must pass an appropriate qualitative (QLFT) or quantitative (QNFT) fit test for each make, model style, and size respirator they may wear, including SARs. Employees must have successfully completed the medical evaluation requirement prior to fit testing.

- Fit testing is not required for voluntary use of dust masks.
- Overall minimum fit factor for full face masks is 500 when using QNFT, and 100 when using QLFT.
- Irritant smoke or Bitrex are no longer used at Salt Lake City.
- Fit testing will be done initially upon employee assignment to an area where respirators are required and will be repeated at least every 12 months thereafter.
  - Exception: Fit testing is conducted twice per year for asbestos workers.
  - Fit testing will be repeated in the event of a physical change in the employee’s features that may affect respirator fit. These may include scarring, dental changes, cosmetic surgery, or gaining or losing weight, or at the request of the employee.
- Fit testing will not be performed on employees who have facial hair that comes between the sealing surface and the respirator face piece or that

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interferes with the respirator valve function.

- Fit testing is conducted using appropriate QTFT and QLFT protocols, in accordance with methods compliant with 29 CFR 1910.134 Respiratory Protection.

If it is determined that an individual cannot obtain an adequate fit with the respirators in stock at the storehouse, then a different respirator will be provided. If an employee is not medically able to wear a negative pressure APR, a PAPR will be provided if it is medically appropriate.

Fit test records will include:

- The employees name,
- The date of the test,
- The name of the tester,
- Respirator brand, model, size, and type, and
- Score for each fit test exercise.

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## Program Evaluation

The Health and Safety Department will conduct an evaluation of this program as needed to ensure the procedures and practices are effectively protecting employees. The evaluation will include consultation with affected employees to determine the following:

- Respirator fit,
- Appropriate respirator selection,
- Proper respirator use under workplace conditions,
- Proper cleaning, storage, and maintenance of respirators,
- Proper inspection and cleaning of respirators, and
- Proper training of employees who use respirators.

The evaluation will be conducted at least annually.

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## TRAINING

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### Frequency

Training must be received initially at time of employment, and before the employee uses a respirator. Retraining will be given at least every 12 months after initial training, and or when one of the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- A workplace situation arises in which retraining appears necessary to ensure safety.

### Training Content

Training will ensure that each employee can demonstrate knowledge of at least the following:

- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;
- What the limitations and capabilities of the respirator are;
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions;
- How to inspect, don and doff, use and check the seals of the respirator;
- What the procedures are for maintenance and storage of the respirator;
- Change-out schedules for filter cartridges;
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators; and
- The requirements outlined in this SWI.

### Recordkeeping

Tesoro Salt Lake City has established procedures for retaining written information regarding the written program, hazard assessments, medical evaluations, current fit testing records, breathing air records, training records, program effectiveness evaluations and any other respirator program record-keeping requirements.

These records are to be maintained by the HSE Department & Health Services and may be paper or computer generated files. This information shall be used to facilitate employee involvement in the respirator program, assist the HSE Department in auditing the adequacy of the program and provide a record for compliance determinations by OSHA.

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- Training and fit-testing records will be kept for the current year plus 10 years.
- Medical evaluation records for respiratory protection will be retained for the duration of employment plus 30 years.
- Respirator inspection records will be retained for the length of service of the respirator.
- Respirator program evaluation records will be retained for the current year plus 7 years.
- A written copy of the current program will be maintained by the Health and Safety Department.

## REVIEW AND REVISION HISTORY

### History of Revisions

The Table below provides the revision history for this Safety Regulation.

Revision	Date	Change Author	Reason for Change
1.0	03/25/85	---	Original Issue
2.0	06/30/97	---	Revised
3.0	12/19/97	---	Revised
4.0	10/05/98	---	Revised
4.0	11/99	---	Review Only
4.0	01/15/03	---	Review Only
5.0	07/07/03	---	Revised
5.0	02/12/04	---	Review Only
6.0	06/07/09	---	Revised
7.0	06/18/09	---	Revised
8.0	01/12/16	K. Groth	Revised to Align with TSHG-021, Respiratory Protection
9.0	6/29/16	A. Alder	Revised to update fresh air requirements for blinding of H2S and benzene streams.

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ORIGINAL ISSUE:	3/25/1985	LATEST REVISION:	1/12/2016	NEXT REVIEW:	1/12/2019

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	<b>SAFE WORK INSTRUCTION</b>				<b>HS-SWI-046</b>	
SALT LAKE REFINERY	<b>Respiratory Protection</b>					
RESPONSIBLE DEPT.	CONTENT STEWARD			APPROVED BY		
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## APPENDIX A – RESPIRATOR SELECTION AND CARTRIDGE CHANGE-OUT SCHEDULE

Substance	Operation / Task	Exposure Range	PEL / TLV	Respirator Required	Change-out Schedule
Asbestos	Break Inspection & Gasket Removal	0.097- 0.004 f/cc	0.1 f/cc	NEA exists and respirators are optional	Daily, or sooner if breathing is restricted
Benzene	Opening Lines /API & DAF Work/ TAR/Spills	<0.1 - 83 ppm	1 ppm (PEL)	Full Face with OV Cartridge, AirLine or SCBA	Daily
Hydrogen Sulfide	Opening Lines / TAR/Excavations	<1 - >10 ppm	10 ppm	Airline Resp or SCBA	N/A
Welding Fumes	Maintenance (Yorktown Data)	2.4 - 3 mg/m3	5 mg/m3	Tesoro employees no longer fit test for ½ face respirators.	N/A
Sulfur Dioxide	CO Boiler Work	<1 to 34 ppm	2 ppm	Full Face with OV/acid gas/ particulate Cartridge	Daily

NEA= Negative exposure assessment and respiratory protection is not required

N/A= Not applicable

ESLI= End of service life indicator

<= Less than

>= Greater than

## APPENDIX B – EXAMPLES OF ACCEPTABLE AND UNACCEPTABLE FACIAL HAIR



The shaded portions are your respirator seal areas. Facial hair is Not Permitted on these portions of the face.

### Unacceptable



Extended Side Burns



Fu Manchu Moustache



Wide Moustache



Full Beard



Goatee & Narrow Moustache



Goatee & Wide Moustache

### Acceptable



Clean Shaven



Narrow Moustache

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## APPENDIX C – PROCESS AREA RESPIRATOR RECOMENDATIONS

PROCESS AREA	TASK	HAZARD	RECOMMENDED RESPIRATORY PROTECTION
API/DAF	Sludge removal	Benzene (<10 ppm)	Full-face APR
CO Boiler - Any level where there are skin leaks	Routine operator duties	Sulfur Dioxide (<20 ppm)	Full-face APR
Unit TAR	Shutdown & steaming	Petroleum Vapors Benzene	Full-Face APR
All Process Units	Vessel/Tank cleaning	Petroleum Vapors Benzene	Full-Face APR
Clay Tower	Clay removal	Petroleum Vapors Benzene	Full-Face APR
	Welding of stainless steel or other metal containing toxic metals (lead, chromium, galvanized metal, cadmium, etc.)	Metals (respiratory protection to be characterized prior to beginning work)	Atmosphere supplying to a full-face APR
Units containing asbestos	Class III asbestos removal	Asbestos fibers	Full-face APR or PAPR
Process units containing H2S	Activities involving H2S	H2S > 10 ppm	Atmosphere supplying respirator (airline or SCBA)
	Emergency response involving fire, Hazmat, confined space rescue	Toxic chemicals and combustion bi-products (CO, etc.)	Atmosphere supplying to a full-face APR
	Sandblasting using low silica media	Particulate/dust/silica	Abrasive blast hood with atmosphere supplying air
	Paint/coating spraying	Solvents	Paint hood with atmosphere supplying air to full-face APR

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