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# 1.0 INTRODUCTION

## 1.1 Purpose

The purpose of this policy is to ensure that health hazards associated with hexavalent chromium, arsenic, beryllium, cadmium, lead and manganese are evaluated, eliminated, or controlled in a consistent manner through sound engineering solutions, operating procedures, hazard awareness, and personal protective equipment.

This safety regulation will focus primarily on hexavalent chromium. All other toxic metals are evaluated case-by-case, based on the Marathon Exposure Assessment Methodology (EXAM). EXAM is used to determine where there is regular or periodic exposure to toxic metals and identify where materials containing toxic metals are located. The definitions section below defines the different metals, their common locations within refining, and associated occupational exposure limits for each.

This procedure is intended to comply with the requirements of Marathon HLT-2017 Toxic Metals Exposure Control Program, OSHA, and Washington State WAC Codes. Local standards for the evaluation and control of Lead R-14-003 and Mercury R-14-006 hazards are separate from this document.

## 1.2 Scope

This policy applies to all Anacortes Refinery employees and contractors.

# 2.0 REFERENCES

## 2.1 Marathon Standards, Policies & Procedures

- HLT-2017, Toxic Metals Exposure Control Program
- HLT-2005, Respiratory Protection Program
- HLT-2025, Medical Surveillance Examinations
- HLT-2003, Management of Employee Exposure and Medical Records
- HLT-2026, Local Exhaust Ventilation Management Program

## 2.2 Government Regulations

- 29 CFR 1910.1026, General Industry
- 29 CFR 1926.1126, Construction
- WAC 296-62, Hexavalent Chromium
- WAC 296-62-074, Cadmium
- WAC 296-62-07521, Lead
- WAC 296-848, Arsenic
- WAC 296-850, Beryllium
- WAC 296-841-20025, Permissible Exposure Limits (PELs)

### 2.3 Source Documents

- 29 CFR 1910.134, Respiratory Protection
- 29 CFR 1910.252, Welding, Cutting and Brazing
- 29 CFR 1910.1000, Air Contaminants
- 29 CFR 1910.1200, Hazard Communication
- In-Depth Survey Report: Control Technology Assessment for the Welding Operations; U.S. Department of Health and Human Services; June 27, 1997; Report No. ECTB 214-13a
- ANSI Z49.1-2005; Safety in Welding, Cutting, and Allied Processes; American National Standards Institute
- API Publication 4629, Hexavalent Chromium Exposures During Hot Work, October 2006

## 3.0 DEFINITIONS

The following definitions are applicable to this procedure.

**Table 1 Definitions**

<table>
<tr><th>Term</th><th>Description</th></tr>
<tr><td>ACGIH</td><td>American Conference of Governmental Industrial Hygienists – a scientific organization which publishes a set of recommended exposure limits for chemical and physical agents.</td></tr>
<tr><td>Action Level (AL)</td><td>Personal exposure, without regard to the use of respirators, to an airborne concentration of the following meals, averaged over an 8-hour period. Typically, 50% of the PEL.<br><br><table><tr><td>Substance</td><td>OSHA TWA AL</td></tr><tr><td>Arsenic</td><td>0.005 mg/m3</td></tr><tr><td>Beryllium</td><td>0.0001 mg/m3</td></tr><tr><td>Cadmium</td><td>0.0025 mg/m3</td></tr><tr><td>Hexavalent Chromium</td><td>0.0025 mg/m3</td></tr><tr><td>Lead</td><td>0.03 mg/m3</td></tr><tr><td>Manganese</td><td>N/A</td></tr></table></td></tr>
<tr><td>Arsenic</td><td>This includes elemental Arsenic and all inorganic compounds, (measured as Arsenic, As), containing Arsenic, but excluding arsine gas. It occurs naturally in water and soil. Arsenic can be harmful to the eyes, skin, liver, kidneys, lungs, and lymphatic system. For MPC operations, the most likely sources of Arsenic are in crude oil, refractory materials, and some catalysts.</td></tr>
<tr><td>Beryllium</td><td>This includes Beryllium in all forms, compounds, and mixtures. For MPC operations, the most likely sources of Beryllium are contaminants in abrasive blasting agents and exotic metals.</td></tr>
<tr><td>Breathing Zone</td><td>The area within a one (1) foot radius of the mouth and nose.</td></tr>
</table>

## Table 1 Definitions

| Term | Description |
| --- | --- |
| Cadmium | This includes Cadmium and Cadmium compounds, in all forms. Cadmium can be harmful to the lungs, bones and kidneys. For MPC operations, the most likely sources of Cadmium are in some catalysts and paint coatings. |
| Fire Box Enclosure | A temporary enclosure, normally built inside of a process area that is designed to contain welding slag and prevent adjacent workers from seeing the arc. The typical enclosure is a small custom built scaffold with fire blanket on the bottom and the sides. In some cases, the top of the firebox enclosure is also covered. These fire box enclosures are sometimes called "hooches" or "spark enclosures". |
| Exposure Assessment | A process for determining the degree and extent of exposure to potentially harmful agents (such as hexavalent chromium welding fumes) that may occur to employees, contractors, visitors and the surrounding community. The following elements should be considered in an exposure assessment:<br>Jobs/positions (exposure groups) and primary tasks where overexposure might occur.<br>The nature and extent of the potential harmful agent, control methods, and PPE for preventing overexposures.<br>Engineering controls, if appropriate and feasible, to reduce exposures, and<br>Potential for exposure to adjoining operations, neighboring facilities and the surrounding community. |
| Exposure Assessment Methodology (EXAM) | A MPC comprehensive strategy for the qualitative and quantitative assessment, statistical analysis, addition of controls, and reassessment of occupational exposure risks. EXAM ensures that exposure assessments, industrial hygiene monitoring and surveys are performed consistently across operations. |
| Gas Monitor | Is a portable electronic device which detects LEL, oxygen, carbon monoxide, H2S and displays a visual, audible, and/or tactile warning. Other sensors may be in place to detect other toxic gases such as sulfur dioxide, etc. |
| Hexavalent Chromium | One form of chrome metal that can be generated during welding or torch cutting of chrome contains alloy steel. In petroleum facilities, hexavalent chrome may also be found in paint pigments, and may have been used in cooling tower water treatment chemicals. |
| Inconel® | A registered trademark name of Special Metals Corporation referring to a family of austenitic nickel-based super alloys, Inconel® alloys are typically used in high temperature applications. |
| Lead | Metallic Lead, all inorganic Lead compounds, and organic Lead soaps. Excluded from this definition are all other organic Lead compounds. Lead can be harmful to the eyes, gastrointestinal tract, central nervous system, kidneys, and blood. Also see R-14-003, Lead Management Program. |
| Local Exhaust Ventilation (LEV) | A mechanical system that captures and removes process<br>contaminants before they are released into the work area environment. The components of an LEV are typically the hood or air capture device, ducting, an air cleaner device, the fan and an exhaust. |
| LEL or LFL | The minimum concentration of a flammable vapor or gas in air that will burn or explode in the presence of an ignition source. Normally rated at ambient temperature and atmospheric pressure; concentrations below the LEL are too lean to burn. |
| LEV or Local Exhaust Ventilation | An air moving device, normally placed within 1 foot of the source of emission, which is designed to capture the contaminant and remove it from the workspace before the contaminant disperses. |

## Table 1 Definitions

| Term | Description |
|---|---|
| Monel® | A trademark of Special Metals Corporation referring to a series of rustless (stainless) metal alloys, primarily composed of up to 67% nickel and copper, with some iron and other trace elements. It is resistant to corrosion and acids, and some alloys can withstand a fire in pure oxygen.<br>It is commonly used in applications with highly corrosive conditions. Small additions of aluminum and titanium form an alloy with the same corrosion resistance, but with very high strength. |
| Manganese | This includes all valence states and compounds. Manganese can be harmful to the lungs, liver, kidneys and central nervous system. For MPC operations, the most likely sources of Manganese are welding and grinding operations. |
| NIOSH or National Institute for Occupational Safety and Health | A US 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 Department of Health and Human Services. |
| Occupational Exposure Limit (OEL) | An exposure limit for a substance designed to protect the health and safety of nearly all workers over a working lifetime, or to protect against acute health effects of a chemical. OELs include MPC's internal OELs and OSHA's Permissible Exposure Limits (PELs). An OEL is typically an eight-hour time-weighted average. Below are the chemicals pertaining to this standard and their respective OELs: |
| PEL or Permissible Exposure Limit | The maximum concentration of a chemical to which a workers can be exposed, averaged over 8 hours. |
| Personal Sample | A quantitative exposure measurement designed to assess an employee's exposure to a given contaminant(s) over a full shift or over the duration of specific work task(s). Personal samples designed to assess full shift exposure should be at least 7 hours in duration, and they must include those periods of work that are expected to produce the highest exposures. For welders, personal samples shall be taken in the welders breathing zone, preferably inside the welder's hood. |
| PPE or Personal Protective Equipment | For welding exposures, PPE can include standard welding protective equipment including welder's helmets with shaded lenses, hearing protection, safety glasses, welder's leather gloves and sleeves, aprons, shoulder covers, jackets, caps, leggings, and boots. Respirators such as disposable welding respirators with adjustable straps and exhalation valves, half face piece masks with suitable P-100 cartridges or pancake filters, powered air purifying respirators incorporated with welder helmets with auto-darkening filters, and supplied-air welding respirators. Based on OSHA's preamble to the 1910.1026 hexavalent chromium standard, disposable flame retardant coveralls are not expected to be required for welding and torch cutting operations. |

| Substance | MPC TWA OEL | OSHA TWA PEL | MPC Ceiling OEL | OSHA Ceiling PEL |
|---|---|---|---|---|
| Arsenic | 0.01 mg/m3 | 0.01 mg/m3 | N/A | N/A |
| Beryllium | 0.00005 mg/m3 | 0.0002 mg/m3 | 0.002 mg/m3 (STEL) | 0.002 mg/m3 (STEL) |
| Cadmium | 0.005 mg/m3 | 0.005 mg/m3 | N/A | N/A |
| Hexavalent Chromium | 0.005 mg/m3 | 0.005 mg/m3 | N/A | N/A |
| Lead | 0.05 mg/m3 | 0.05 mg/m3 | N/A | N/A |
| Manganese | 0.2 mg/m3 | N/A | 5 mg/m3 | 5 mg/m3 |

**Table 1 Definitions**

| Term | Description |
| --- | --- |
| Qualified Individual | A designated person who as a result of sufficient formal education and/or job experience is able to accurately evaluate and assess welding operations and exposure data to determine/assign exposure sampling strategies, engineering and administrative controls, and personal protective equipment, necessary to the protection of human health. |
| SAR or Supplied Air Respirator | A positive pressure respirator which provides the user with an independent source of breathing quality air. |
| Temporary Fabrication Area | A designated area, normally located outside the battery limits, where welders fit and fabricate their work prior to final installation in the operating unit |
| TWA or Time Weighted Average | A common method of measuring full shift exposure to chemical and physical agents; the TWA is mathematically expressed as the sum of the measured concentrations multiplied by the times each concentration was measured divided by the total time of the sample duration or the time length of the full shift. |
| Welding Fume | A complex mixture of fumes, gasses and particulates generated in the course of joining materials, usually metals (such as steel, aluminum, brass, stainless steel etc.) or thermoplastics, by melting the work pieces and/or a filler material to form a pool of molten material (the weld puddle) that cools to become a strong joint. The composition will vary depending upon the process and materials involved. |
| Welding Shop | A building designated for the purpose of processing material by cutting, grinding, welding, or similar process. |

## 4.0 ROLES AND RESPONSIBILITIES

### 4.1 Supervision

Supervision is responsible for:

- Ensuring that employees and contractors follow the safe work practices outlined in this document.
- Contacting the Health and Safety Department for assistance when unusual work tasks or circumstances arise, or when there is a question about practices required.
- Ensuring that employees are current with required training.

### 4.2 Employees

Employees are responsible for the following:

- Following the safe work practices outlined in this document.
- Completing required training.
- Contacting the Health and Safety Department for assistance when unusual work tasks or circumstances arise, or when there is a question about practices required.

## 4.3 Health and Safety Department

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

- Anticipating and recognizing potential exposures following the EXAM process.
- Implementing the requirements of this standard.
- Developing and maintaining written plans as necessary.
- Surveying work locations or assignments to determine where there are regular or periodic exposure to toxic metals.
- Assisting with determining which process areas must be posted as regulated areas.
- Assisting with determining appropriate PPE for unusual work tasks or potential exposures.
- Providing necessary content for training.
- Maintaining required records.
- Periodically review the toxic metals program.
- Assisting in design reviews for controls.

## 4.4 Medical Department

The Medical Department is responsible for:

- Implementing the respiratory protection medical surveillance program.
- Notifying the employee and supervision of the medical surveillance program results.

## 4.5 Contractors

Contractors must:

- Assess the need to have an established and compliant plan; and writing and implementing said plan(s) if required.
- Provide their employees with all the required training, PPE, other requirements outlined herein.

## 4.6 Training Department

The Training Department is responsible for the following:

- Providing training materials that have been prepared in conjunction with the HES Department.
- Ensuring employees are current on relevant trainings.

# 5.0 TOXIC METAL PRACTICES

## 5.1 Recognition of Toxic Metals

Based on the Marathon Exposure Assessment Methodology (EXAM), determine where there is regular or periodic exposure to Toxic Metals and identify where materials containing Toxic Metals are located. Materials are assumed to contain Toxic Metals until bulk laboratory analysis or other documentation determines otherwise.

- Only laboratory analysis may be used to determine negative lead content of surface coatings. The use of X-Ray Fluorescence (XRF) devices is limited to confirming positive lead content.

## 5.2 Evaluation of Toxic Materials

The Anacortes Refinery conducts air monitoring that is consistent with Marathon EXAM, Industrial Hygiene measurements procedure manual, and federal, state, and local authorities.

Personnel are notified of air monitoring results with the timeframe set forth in the applicable OSHA standard and HLT-2003 Management of Employee Exposure and Medical Records.

In the absence of air monitoring data for Hexavalent Chromium, the Marathon API Hexavalent Chromium Calculator is to be used for evaluating exposure and establishing control methods for employees and contractors (see Attachment 1).

The Anacortes Refinery investigates alternatives to materials containing toxic metals in order to minimize the extent that toxic metals-containing materials are used, without compromising quality or integrity of operations.

## 5.3 Control of Toxic Metals

The Anacortes Refinery and contractors shall implement the following when applicable:

- Use engineering and work practice control measures to maintain personnel exposure below the OEL and where exposures cannot be maintained below the OEL, use controls to reduce exposures to the lowest feasible level, and provide personnel with appropriate respiratory protection.
    - Job rotation is prohibited as a means of obtaining compliance with the OEL.
- Develop and implement a written Employee Exposure Control Plan when personnel exposures exceed the Action Level for 30 or more days per year.
- Include Covered Employees in the appropriate medical surveillance group in accordance with HLT-2025.
- Provide hygiene facilities and hygiene practices, as required in the applicable OSHA standard when exposure exceeds the Permissible Exposure Limits.
- Dispose of Toxic Metals-containing wastes in a manner that minimizes the release of Toxic Metals and that complies with appropriate regulatory requirements.
- Implement training and awareness programs where the potential for exposure to Toxic Metals compounds is present, to provide employees with information on

hazards associated with Toxic Metals and the measures established to control exposure.

- Post warning signs (when OEL is exceeded or lack of data) that demarcate Regulated Areas and label all products, per federal and state requirements, including waste containers.

## 6.0 HEXAVALENT CHROMIUM SPECIFIC WORK PRACTICES

### 6.1 Sources of Hexavalent Chromium

Chromium is a metal and exists in several different forms: divalent, trivalent, and hexavalent. Only hexavalent chromium (i.e., 4-12% chrome and stainless steel series 330 and 400 materials) is currently recognized as a human carcinogen and has the potential to cause lung cancer in humans.

Hexavalent chromium has many uses. It is used as a pigment in paints, inks, and plastics; as an anti-corrosion agent in protective coatings; and in chrome plating. It has also been used in cooling tower water treatment chemicals.

Workers in many different occupations have the potential to be exposed to hexavalent chromium. Occupational exposures are higher among workers who:

- Handle dry chromate-containing pigments
- Spray chromate-containing paints and coatings
- Operate chrome plating bathes; and
- Weld or cut chromium-containing metals such as stainless steel.

Welding and torch cutting of chromium-containing metals is expected to be the primary source of exposure in petroleum facilities. In welding or cutting of chromium-containing metals, the intense heat of the arc or flame vaporizes the base metal and/or the electrode coating. This vaporized metal condenses into tiny particles called fumes which can then be inhaled. Without adequate control measures, welding on these materials can potentially lead to exposures above the legal permissible exposure limit of 0.005 milligrams per cubic meter (mg/m3) of air for an 8-hour time-weighted average (TWA).

### 6.2 Routes of Entry Into the Body

Hexavalent chromium, like most other toxic metals, enters the body in one of two ways: by being inhaled or by being ingested (i.e., swallowed).

Chromium can be inhaled when chromium dust, mist, or fumes are suspended in the air. This usually occurs during the welding or cutting operation or shortly thereafter.

Particles of chromium can also be ingested if the dust gets on the hands, clothing, or on food or drink after exposing oneself to a contaminated material.

### 6.3 Health Effects

Prolonged hexavalent chromium exposures have the potential to affect the respiratory tract, lungs, skin, and eyes.

- Respiratory Tract

  Hexavalent chromium can irritate the nose, throat, and lungs. Repeated exposure can damage the mucous membranes of the nasal passages and cause ulcers to form. The damage may be so severe that the septum (the wall separating the nasal passages) develops a hole in it.

- Lungs

  Studies of workers in the chromate production, pigment industries, and chrome platers have shown increased rates of lung cancer when exposed to hexavalent chromium in the workplace for long periods of time. Studies of stainless steel welders are inconclusive at this time. However, an individual worker's actual risk depends on how much one is exposed to in the workplace and how long the exposure goes on. That is why it is important to take the necessary steps to reduce worker exposures immediately.

- Skin

  Hexavalent chromium is very irritating to the skin. Prolonged contact can cause ulcers to form. Some workers may develop an allergic sensitization to chromium. In sensitized workers, contact with even small amounts of chromium can cause a serious skin rash.

- Eyes

  Hexavalent chromium can also be an eye irritant. Direct contact with chromic acid or chromate dusts can cause permanent eye damage.

## 6.4 Exposure Limits and Exposure Determination

The OSHA standard established a permissible exposure limit (PEL) of 0.005 milligrams per cubic meter (mg/m3) in air for an 8-hour time weighted average (TWA). This means that over the course of any 8-hour work shift, the average exposure to hexavalent chromium cannot exceed 0.005 mg/m3. An action level of 0.0025 mg/m3 in air for an 8-hour TWA has also been established by this standard.

Exposures above the action level trigger specific requirements and exposures above the PEL trigger additional requirements. If monitoring indicates that employee exposures are below the action level, monitoring may be discontinued for those employees whose exposures are represented by such monitoring. If monitoring reveals that employee exposures to be at or above the action level, the employer shall perform periodic monitoring a least every six months.

**Table 2 Monitoring Frequency**

| Exposure Scenario | Required Monitoring Activity |
| --- | --- |
| Below the Action Level (<0.0025 mg/m3) | No periodic monitoring required for workers represented by the initial monitoring. |
| At or above the Action Level, but at or below the PEL (0.0025 mg/m3 to 0.005 mg/m3) | Monitor every six (6) months. |
| Above the PEL (> 0.005 mg/m3) | Monitor every three (3) months. |

## 6.5 Exposure Assessments

6.5.1 Initial air sampling and interim exposure control measures

Until comprehensive facility air sampling on hexavalent chromium welding fumes has been completed and analyzed, the Marathon API Hexavalent Chromium Calculator is to be used for evaluating exposure and establishing control methods for employees and contractors.

Attachment 1 contains the Marathon API Hexavalent Chromium Calculator.

Attachment 2 contains a table with respiratory protection recommendations for different types of welding/grinding tasks and conditions. This may be used as an additional reference, but not in place of the API Hexavalent Chromium Calculator.

6.5.2 Using contractor's exposure controls

Contracted welding companies may present exposure monitoring results for consideration that indicate controls, other than those in Attachment 1. These results will be reviewed by the Industrial Hygienist to determine if the controls dictated by the monitoring results can be considered acceptable to control welding fumes.

## 6.6 Exposure Monitoring

The Anacortes Refinery has an exposure assessment and monitoring strategy that is aligned with Marathon's Exposure Assessment Methodology (EXAM). This ensures that we have an integrated framework of recognized industrial hygiene practices for the anticipation, recognition, evaluation and control of potential occupational and environmental health hazards. EXAM ensures that exposure assessments, industrial hygiene monitoring and surveys are performed consistently and cost effectively across operations.

6.6.1 Initial exposure monitoring

The employer will conduct a sufficient number of personal samples to accurately characterize full shift exposures to welding fumes from the various types of welding done by employees. The number of samples will be sufficient to ensure that the process is properly evaluated.

- IF initial monitoring finds that employees are exposed to welding fumes greater than the action level AND the type of welding is done frequently enough to allow, THEN sampling is repeated at least every six months.
- IF initial monitoring finds that employees are exposed to welding fume component(s) greater than permissible exposure limit(s), AND the type of welding is done frequently enough to allow, THEN sampling is repeated at least every three months.
- Requirements to repeat air monitoring apply whether employees are wearing proper respiratory protection or not.

6.6.2 Discontinuing periodic air monitoring

- IF two consecutive personal samples, taken at least seven (7) calendar days apart, indicate that welding fume exposures are below the action level, THEN the employer may discontinue periodic personal air monitoring.
- The consecutive personal samples must be taken using the following variables to simulate actual working conditions that are expected to cause the greatest exposures to the contaminants of concern:
  - welding rods,
  - base metals,
  - ventilation,
  - work processes,
  - personnel, and
  - work locations
- IF any variable is changed to reduce the potential for employee exposure, THEN the change is documented in the exposure monitoring records for the consecutive samples.

6.6.3 Contaminant testing requirements

Welding fume air samples are taken to analyze for the contaminants of concern. Expectations regarding the composition of the welding fumes can be developed by reviewing the composition of the base metal and the composition of the welding rods and/or other consumables.

OELs for the welding rod and base metal components are taken into account when sampling. Samples are collected for the elements that are present in the highest concentration with the lowest OELs.

The standard method of sampling to test for hexavalent chromium is OSHA ID-215. Samples must be analyzed within 8 days of collection.

6.6.4 Sampling documentation

All personal exposure monitoring records are readily accessible in AIMS, Marathon's IH data management program.

6.6.5 Notification of Sampling Results

- Employees will be notified in writing or via a posting in their work area the results of monitoring within 5 days of Marathon receiving the laboratory results. A formal report will be issued within 15 days of receipt.
- Whenever the exposure determination indicates that employee exposure is above the PEL, Marathon shall describe in the written notification the corrective action being taken to reduce employee exposure to levels at or below the PEL.

6.6.6 Observation of Monitoring

- Where air monitoring is performed to comply with the requirements of this section, Marathon shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to hexavalent chromium.
- When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required, Marathon shall provide the observer with clothing and equipment and shall assure that the observer uses such clothing and equipment and complies with all other applicable safety and health procedures.

## 6.7 Regulated Areas

A regulated area is an area demarcated by the employer, where an employee's exposure to airborne concentrations of a toxic metal exceeds, or can reasonably be expected to exceed, the PEL. The area will be demarcated from the rest of the workplace so that it adequately establishes and alerts employees of the boundaries of the affected area.

Use warning signs, barrier rope or tape to demarcate the affected area in addition to the barrier tag which will identify the hazard, authorized entrants, etc. in accordance with R-11-024, Safety Signs, Ground Level Warnings and Barricades.

Authorized personnel in the regulated area must be equipped with appropriate respiratory and other protective equipment as necessary to minimize potential exposure to hexavalent chromium.

## 6.8 Control Measures

Whenever exposures to hexavalent chromium exceed the PEL, employers must use engineering and work practice controls to reduce and maintain exposures at or below the PEL. The best protective measure is to substitute the material for a less toxic material or process. If this cannot be done, isolation, followed by consideration of local exhaust ventilation to capture and remove welding fumes at the point of generation. Strategic placement of a local exhaust will help reduce or prevent over-exposures to hexavalent chromium.

Work practice controls involve adjustments in the way that a task is performed and can often complement engineering controls in providing protection to the workers. For example, welders can be trained to position themselves and the local exhaust ventilation to best minimize exposure to welding fume.

In situations where local exhaust ventilation is not possible, respiratory protection may be required for working on alloy steels or using stainless steel rods or wire, even if such rods or wire are being used on mild carbon steel. Refer to Attachment 1 for guidance.

## 6.9 Respiratory Protection

6.9.1 Air Purifying Respirators

- Welders will use NIOSH approved, designed and constructed respirators for protection against welding fumes and hexavalent chromium.

- Respirators will be worn so that they do not interfere with the other PPE that the welders may be required to wear.
- See Attachment 1 for selecting appropriate respiratory protection.

6.9.2 Supplied Air and Entering/Exiting Work Areas

- In some situations, welders will need breathing air at the work area, but an APR will be sufficient when climbing to and from the work site. In these cases, welders shall wear the SAR that automatically converts to APRs after the air hose is disconnected. Welders may disconnect their breathing air hoses and operate their respirators in the APR mode when climbing to and from the work area. This will minimize the chances that the airline will become tangled and result in a fall.
- When the SAR is operated in the APR mode, no welding related work is to be performed by the employee until the airline is re-connected. WHEN the employee enters the work area, THEN they will connect the airline converting the APR to SAR mode as soon as possible AND prior to beginning work.
- IF the employee disconnects the airline to exit the work area, THEN they will leave the area immediately.

## 6.10 Protective Work Clothing and Equipment

Clothing can become contaminated with hexavalent chromium when performing work that generates or stirs dust containing chromium. Contaminated clothing must not be removed from the workplace by anyone other than an employee whose job it is to launder or dispose of such clothing. This section applies to work that may cause clothing contamination and generally pertains to work areas in which hexavalent chromium is present above the action limit.

6.10.1 Preventive measures

Contamination may be prevented following procedures similar to those used to prevent lead clothing contamination, including use of disposable coveralls and decontamination facilities such as change rooms. Disposable overalls, such as Tyvek, must be disposed of in sealed and labeled containers.

6.10.2 De-contaminating Clothing

If clothing that will be re-worn becomes contaminated, the following applies:

- Contaminated PPE and clothing will be laundered or disposed of in such a way as to minimize potential exposure. Hazard warning labels on the containers are required to identify that it is contaminated with hexavalent chromium.
- Control the release of dust below the PEL (shaking and blowing contaminated clothing or equipment is prohibited).
- Commercial laundry services will be notified of the presence of hexavalent chromium contamination.

## 6.11 Hygiene Areas and Practices

This section applies to work that may cause skin/clothing contamination and generally pertains to work areas in which hexavalent chromium is present above the action limit.

- Washing facilities shall be provided to remove contamination from face, neck, hands and arms. Employees shall wash at the end of work shift.
- Prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using toilet facilities, workers shall wash their hands and face. Also, areas where these articles are used or stored shall be kept as free of hexavalent chromium as possible.
- Before entering eating and drinking areas, work clothing or equipment contaminated with hexavalent chromium shall have contaminants removed by vacuuming with HEPA filter attachment and/or wet methods, i.e., methods that do not spread contamination.

## 6.12 Medical Surveillance

A medical surveillance program is available to employees who are or may have been exposed to hexavalent chromium under the following conditions:

At or above the action level for 30 or more days a year; Experiencing signs or symptoms of the adverse health effects associated with chromium (VI) exposure as outlined in section 6.3 - "Health Effects" of this procedure; or an emergency exposure to high levels of chromium (VI).

**NOTE**: There are no routine medical tests to measure the amount of hexavalent chromium that has been absorbed into the body. OSHA does not require any specific biologic chromium exposure measurements but does require a physical examination of the skin and respiratory tract for employees included in a hexavalent chromium medical surveillance program.

## 6.13 Ventilation

In work areas where there is potential exposure to chemical or physical agents in excess of the established exposure limits, local exhaust ventilation (LEV) will be given priority consideration to control and minimize employee exposure. Local exhaust ventilation is considered superior to respiratory protection because contaminants are collected at the source and because it is less subject to failure or misuse.

The Anacortes Refinery LEV program is administered by the site Industrial Hygienist. Permanent LEV systems (weld shop snorkels) are utilized daily in the refinery to control hazards in the Welding Shop. Temporary LEV is also a consideration for welding jobs in the field and during turnarounds. When LEV is used to control exposure, the Industrial Hygienist helps select the most appropriate system for controlling and minimizing the exposure. Guidelines for the selection of LEV can be found in the ACGIH Industrial Ventilation Manual.

Since LEV is the highest priority control for protecting employee health, maintaining the systems is of high importance. The following requirements are followed to ensure continuous and effective operation of LEV systems:

- All snorkels in service in the refinery must follow the requirements of RSP-1801-001, Fume Hood System Requirements for Refinery and RAD Laboratories.
- Annual ventilation surveys are performed by the Industrial Hygienist on all permanently installed weld shop snorkels. Recommended snorkel capture velocities must be > 50 cfm. Repair recommendations are made based on findings.
- For permanently installed LEV systems used in welding applications, continuous monitoring of the LEV system is required using visual and/or audible indicators that allow the user to verify it is working as originally designed or within applicable specifications.
- Preventive maintenance is performed at scheduled intervals on LEV systems in the welding shop.
- Training on the proper use of LEV. This includes covering the importance of LEV use, hazard communication, and basic local exhaust principles.

6.13.1 Welding Shops

A. New welding shops

New weld shops will have all the following characteristics:

- A ceiling height of at least 16’
- One or more exhaust fans shall be located near the ceiling to remove welding fumes from the shop. This exhaust fan shall be maintained in good working order and will operate whenever welding or cutting is performed.
- At least two large overhead doors. If the climate permits, both doors will remain open whenever welding or cutting is taking place.
- Arc flash screens shall be provided and used during welding and cutting activities in shops. These screens shall allow about two feet of open space at the bottom to facilitate vertical air flow.

B. Existing welding shops

Existing weld shops will have all the following characteristics:

- Equipped with at least one local exhaust ventilation (LEV) device, IF the LEV device does not filter the welding fumes, THEN the discharge point is located so that there is no exposure to exhausted welding fumes.
- Arc flash screens are used during welding and cutting activities. Screens shall allow about two (2) feet of open space at the bottom to facilitate vertical air flow.

C. Warning signs

Welding shops will post a warning sign when working on alloy steel where potential exposures could occur.

6.13.2 Temporary Fabrication Areas

A. Temporary fabrication area requirements

Temporary fabrication areas will have all the following characteristics:

- Equipped with non-combustible arc flash screens so that adjacent workers will not be visually exposed to the arc. Arc screens shall allow at least two feet of open space at the bottom to facilitate vertical air flow.
- IF the enclosure around the fabrication area includes a ceiling, THEN all of the following applies:
  - The side walls must have an opening of about 2' between the top of the wall and the ceiling,
  - Mechanical ventilation shall be considered when welding and cutting is taking place. Natural ventilation has proven to be adequate when temporary fabrication areas are constructed outdoors with 2' openings at top and bottom of area. Consult with the Industrial Hygienist to review design options and historic monitoring results.

B. Warning signs

Fabrication areas will post a warning sign when working on alloy steel where potential exposures could occur.

6.13.3 Fire Box Enclosures

Half-face respirators with "P-100" (HEPA) filters are required for welding and grinding inside fire box enclosures.

IF mechanical ventilation is used for fire box enclosures, THEN the ventilation system shall include a gate valve or switch that is under the direct control of the welder.

The welder will adjust the position and rate of the ventilator so that:

- Excessive fumes are removed from the work area.
- Welding fumes are not discharged into the breathing zone of nearby workers.
- Slag is not ejected from the enclosure to an unprotected area.
- Weld quality is maintained.

6.13.4 Other Confined Spaces

- To limit exposure, entry into confined spaces is restricted during welding to those employees necessary to the welding task. Everyone entering a confined space during welding operations will adhere to the eye and respiratory protection requirements for the task being performed.
- A minimum ventilation rate of 2000 CFM per welder shall be maintained unless local exhaust hoods are utilized or airline respirators are worn, in accordance with 1910.252(c)(2).
- Inert gas welding in confined areas requires continuous air monitoring near the welders. IF there is any possibility that inert gas welding will reduce

the normal percentage of ambient oxygen, THEN supplied air respiratory equipment is required in addition to continuous monitoring.

- Arc gouging in confined spaces requires supplied air respiratory protection unless continuous air monitoring shows that carbon monoxide (CO) concentrations are remaining below 35 ppm. IF CO concentrations remain <35 ppm, THEN the minimum respiratory protection requirement is a half face respirator with P-100 cartridges.
- Continuous air monitoring is required for each welder AND for each entrant in a confined space during inert gas welding. The number of other non-essential entrants in the confined space will be minimized.

## 6.14 Work Other Than Welding of Torch Cutting

### 6.14.1 Abrasive Blasting

IF abrasive blasting paints, THEN do the following:

- Review the safety data sheets for paints and primers used at the facility to determine if chromium containing paint has been used.
- Procedures for abrasive blasting of chromium containing paint will be similar to procedures used for abrasive blasting lead-based paint.

### 6.14.2 Working on the Cooling Water Towers

Residual chromium may be adsorbed into wooden structures of cooling towers if chromium containing water treatment additives have been used in the towers.

IF work is done on cooling towers that can disturb the wooden structure and generate dust, THEN monitor for airborne hexavalent chromium.

Until comprehensive monitoring results are available, workers will wear disposable protective clothing and half-face respirators with P-100 filters.

## 6.15 Contractors

### 6.15.1 Contractors' Policy

Contractors will develop and maintain a hexavalent chromium welding fume control procedure that provides at least the same level of worker protection as this policy.

### 6.15.2 Exposure Assessments

Contractors will conduct exposure assessments, including air monitoring, for their employees.

Marathon reserves the right to monitor on-site contractors. The results of the monitoring will be provided to the contractor representative.

### 6.16 Training

6.16.1 Initial Training

Welders and their supervisors who may be exposed to hexavalent chromium in concentrations above the action level will receive training on:

- Potential health hazards of welding fumes.
- Proper use of ventilation, respiratory protection, and other control measures as it applies to hexavalent chromium exposure from welding and torch cutting.
- Proper practices for wearing a personal pump for chromium fume monitoring.
- Relevant portions of the hexavalent chromium standard (1910.1026).
- Protecting adjacent personnel by work practices such as barricading and posting areas where airborne chrome concentrations may exceed the PEL.
- Summary of exposure monitoring results for hexavalent chromium.
- Personal hygiene as a method of reducing exposure.
- The training will be documented.

6.16.2 Annual Refresher Training

Refresher training will be given to employees with the potential for exposures above the action level, and to their supervisors.

## 7.0 REVIEW AND REVISION HISTORY

| Revision # | Preparer | Date | Description |
| --- | --- | --- | --- |
| 0 | Mark Willand | 11/5/2021 | Reformatted and Numbered per Document Control Policy, R-63-001. |
| 1 | Michael Fazio | 7/3/2024 | Line by line review. Updated Content Custodian and Approver. Updated procedure reference and para 6.14.1. |
| | | | |
| | | | |

## 8.0 ATTACHMENT 1 – HEXAVALENT CHROMIUM EXPOSURE CHART

| Hexavalent Chromium Exposure Determination | | | |
|---|---|---|---|
| **Site** | **Date** | **Area** | **Description** |
| | | | |
| **Unit #** | | **Equipment #** | |
| | | | **Toxic** |
| **Fire Work Method: Select only ONE below** | | | |
| | **Score** | **Fume Level** | **Fire Work Process** |
| ☐ | 9 | High Fume Producing | Stick Welding, Arc Gouging, Torch Cutting |
| ☐ | 3 | Medium Fume Producing | MIG Welding, Plasma Cutting, Grinding |
| ☐ | 1 | Low Fume Producing | TIG Welding |
| **Chrome Content (refer to attached Cr content table): Select only ONE below** | | | |
| | **Score** | **Chrome Content** | **Percentage of Chrome in Base Metal or Filler rod/wire** |
| ☐ | 9 | High Chrome Content | 17% |
| ☐ | 3 | Medium Chrome Content | 9% - 17% |
| ☐ | 1 | Low Chrome Content | 0.5% - 9% |
| ☐ | -5 | Very Low Chrome Content | Less than 0.5% Chrome (Carbon Steel, Galvanized, Ductile Iron) |
| **Work Area: Select only ONE below** | | | |
| | **Score** | **Type of Space** | **Description** |
| ☐ | 9 | Confined Space | Includes all small confined spaces. For large confined spaces consult the IH for determination |
| ☐ | 3 | Semi- Enclosed | Includes Weld Bays, Spark Enclosures and Indoor Shops without local exhaust ventilation |
| ☐ | 1 | Open Air Location | Includes only open air welding without any barriers (i.e.,no fire blanket or other such materials that may block air flow.) |
| **Duration Per Shift (Time spent actually performing fire work, not to be used as a job rotation schedule)** | | | |
| | **Score** | **Type of Shift** | **Description** |
| ☐ | 4 | Long (Full Shift) | More than 6 hours of actual time creating emission (striking a weld, etc.) |
| ☐ | 2 | Moderate (Half Shift) | Between 4 and 6 hours of actual fire work |
| ☐ | 1 | Short | Between 2 and 4 hours of actual fire work |
| ☐ | -1 | Very Short | Less than 2 hours of actual fire work |
| **Ventilation (Subtract from total score)** | | | |
| | **Score** | **Type of Ventilation** | **Description** |
| ☐ | -8 | Local Exhaust Ventilation | Local Ventilation that captures the point source of the emission |
| ☐ | -4 | Dilution Ventilation | General dilution ventilation (i.e. Copus Blower, Air Horn) |
| ☐ | 0 | N/A | No other ventilation used |
| **Total Score** | | **See Description of compliance method based on score.** | |
| | | The use of monitoring data may override this determination as it may provide additional data. | |

**Regulated Tasks or "Hot Zones": 19 Points or Greater**

- **Same items as Controlled Tasks Plus:**
  - **Respiratory Protection**: A minimum of a P100, or HEPA, ½ mask Air Purifying Respirator (APR). Higher protection factor respirators may be needed in some other instances. Persons performing alloy fire work inside a confined space shall wear supplied air respiratory protection. Consideration for respiratory protection shall be given to individuals working in proximity of alloy fire work. Contact the IH for assistance.
  - **Outer Clothing:** Workers performing fire work must wear an outer layer of clothing, or other protective suit, that is properly decontaminated or discarded after each shift, before taking a break or at the end of the job; whichever comes sooner.
  - **Hygiene**: Hand and face washing facilities are to be readily available. Workers shall not eat, drink, smoke or use smokeless tobacco until after decontaminating the outer layer of clothing and washing their hands and face.
  - **Decontamination:**
    - All contaminated materials that are not cleaned shall be bagged and sealed, and labeled with a "Hexavalent Chromium" warning label either for waste or laundry service.
    - All surfaces should be maintained as free as practical of Cr+6 accumulations. Wet or HEPA methods should be utilized for decon. Compressed air blowing shall not be used. Areas that do not need to be decontaminated include: confined spaces that will return to process service and open air locations such as pipe racks, gravel areas, etc.
- **Contact the Industrial Hygienist for sampling advice and scheduling.**

**CrVI Controlled Tasks: 10 to 18 Points**

- **Same items as Conditional Tasks Plus:**
- **Respiratory Protection**: A minimum of a P100, or HEPA, ½ mask Air Purifying Respirator (APR). Higher protection factor respirators may be needed in some other instances. Persons performing alloy fire work inside a confined space may need to wear supplied air respiratory protection. Hexavalent Chromium concentration alone is unlikely to require supplied air respirators under these circumstances, but other hazards as defined by the permit may warrant use of supplied air respiratory protection. Consideration for respiratory protection shall be given to individuals working in proximity of alloy fire work. Contact the IH for assistance.

**Conditional Tasks: 4 to 9 Points**

- **Employee Awareness:** Training required for all personnel participating in all work
- **Exposure Monitoring:** Representative sampling should be performed on alloy work greater than 2 hours in length total fume producing time. For carbon steel, monitoring should be considered for further evaluation, contact OS&H Coordinator for guidance.

**Tasks Not Regulated: Less than or equal to 3 Points**

No additional control measures beyond standard fire work protocols and prudent personal hygiene methods.

*Welding operations chrome content is determined from consumable electrode.
*Cutting operations chrome content is determined from base metal.

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**Chrome Content**

| Low Chrome Content: 0.5 - 9% | |
|---|---|
| **Material Type** | **Chrome Contents (%)** |
| 1 Cr | 0.8 - 1.25 |
| 1 1/4 Cr | 1.0 - 1.5 |
| 2 1/4 Cr | 1.9 - 2.6 |
| **Medium Chrome Content: > 9 - 17%** | |
| **Material Type** | **Chrome Contents (%)** |
| 9 Cr | 8.0 - 10.0 |
| 405 Stainless (ss) | 11.5 - 14.5 |
| 410/410S (ss) | 11.5 - 13.0 |
| 17-4 PH (ss) | 15.5 - 17.5 |
| Alloy 600 | 14.0 - 17.0 |
| Alloy C-276 | 14.5 - 16.5 |

| High Chrome Content > 17% | |
| --- | --- |
| **Material Type** | **Chrome Contents (%)** |
| 304/304L (ss) | 18.0 - 20.0 |
| 308 (ss) | 19.0 - 21.0 |
| 309 (ss) | 22.0 - 24.0 |
| 310 (ss) | 24.0 - 26.0 |
| 316/316L (ss) | 16.0 - 18.0 |
| 317/317L (ss) | 18.0 - 20.0 |
| 321 (ss) | 17.0 - 19.0 |
| 347 (ss) | 17.0 - 19.0 |
| 904L (ss) | 19.0 - 23.0 |
| Alloy 20 | 19.0 - 21.0 |
| AL-6X (ss) | 20.0 - 22.0 |
| Nitronic 50 | 20.5 – 23.5 |
| Nitronic 60 | |
| Diplex 2205 (ss) | |
| Alloy 800/800H | 19.0 – 23.0 |
| Inconel 625 | 20.0 – 23.0 |
| Alloy 825 | 19.5 - 23.0 |

| Welding Filler Material Not Included Above | |
| --- | --- |
| **Material Type** | **Chrome Contents (%)** |
| Inconel 117 Electrode | 21.0 - 26.0 |
| Inconel 617 | 20.0 - 24.0 |
| Inconel 82 | 20.0 Average |
| Inconel 182 | 14.0 Average |
| Inconel A | 15.0 Average |
| Inconel 112 | 21.5 Average |

## 9.0 ATTACHMENT 2 – RESPIRATORY PROTECTION AND VENTILATION SUPPLEMENTAL TABLE FOR WELDING ND TORCH CUTTING

| Environment | Open Areas[1] | | | Enclosed[2] or Confined Spaces[3] (All Metals) | | | Partial Enclosures | | |
|---|---|---|---|---|---|---|---|---|---|
| Ventilation | Natural Ventilation | | | Mechanical Ventilation | | | Ventilation Unknown | | |
| Welding Process[4] | Carbon Steel[5] | Alloy Metals | | ≥ 2000 CFM/welder | < 2000 CFM/welder | | Carbon Steel – Less than two sided enclosure | Carbon Steel – More than two sided enclosure | Alloy Metals – More than two sided enclosure |
| **Stick** | No respiratory protection required | Half Face with P-100 or HEPA filters | | Half Face with P-100 or HEPA filters | Half Face with P-100 or HEPA filters with local exhaust ventilation, or use Supplied Air | | No respiratory protection required | Half Face with P-100 or HEPA filters | Supplied Air[6] |
| **MIG** | No respiratory protection required | Half Face with P-100 or HEPA filters | | Half Face with P-100 or HEPA filters | Half Face with P-100 or HEPA filters with local exhaust ventilation, or use Supplied Air | | No respiratory protection required | Half Face with P-100 or HEPA filters | Supplied Air[6] |
| **TIG** | No respiratory protection required | Half Face with P-100 or HEPA filters | | Half Face with P-100 or HEPA filters | Half Face with P-100 or HEPA filters with local exhaust ventilation, or use Supplied Air | | No respiratory protection required | Half Face with P-100 or HEPA filters | Supplied Air[6] |
| **Arc Gouging** | No respiratory protection required | Half Face with P-100 or HEPA filters | | Supplied Air (for gouger only unless CO exceeds PEL ) | With local exhaust ventilation, Half Face with P-100 or HEPA filters provided CO remains below PEL, or use Supplied Air for all inside confined space with ongoing gouging | | No respiratory protection required | Half Face with P-100 or HEPA filters | Supplied Air[6] |
| **Torch Cutting** | No respiratory protection required | No respiratory protection required | | Half Face with P-100 or HEPA filters | Half Face with P-100 or HEPA filters with local exhaust ventilation, or use Supplied Air | | No respiratory protection required | Half Face with P-100 or HEPA filters | Supplied Air[6] |

**Note 1**: Hot work inside shops requires local exhaust ventilation or dilution ventilation rates > 2000 CFM per welder

**Note 2:** Enclosures are spaces with a volume <10,000'$^3$/welder, ceiling height < 16' or barriers that obstruct adequate cross ventilation (moving fumes horizontally away from the welder's breathing zone)

**Note 3:** Confined spaces are small, restricted spaces, such as those inside vessels or equipment

**Note 4**: Recommendations based on previous removal of surface coatings such as paint or primer

**Note 5:** Half face respirators should be used for open air welding on galvanized metals

**Note 6:** If outdoors, with adequate natural ventilation (2' openings on bottom/top), air monitoring has shown half-face w/ P-100 to be appropriate. Consult with IH.