Contents

List of Tables

List of Figures

1.0 INTRODUCTION

1.1 Purpose

The purpose of this procedure is to establish the minimum requirements for managing and operating personal air monitoring equipment, and to provide an overview of the exposure assessment and monitoring strategy for the Anacortes Refinery.

1.2 Scope

This procedure applies to Anacortes Refinery employees and contractors. All personnel working on property must comply with this procedure.

2.0 REFERENCES

2.1 Marathon Standards, Policies & Procedures

- HLT-2001, Industrial Hygiene Program
- HLT-2003, Management of Employee Exposure and Medical Records
- HLT-2024, Employee Exposure Notification Procedure
- HLT-2026, Local Exhaust Ventilation Management Program
- HLT-2027, Community Exposure Guidelines and Occupational Exposure Limits

2.2 Other

- AIHA, A Strategy for Assessing and Managing Occupational Exposures, Third Edition
- ACGIH, Threshold Limit Values and Biological Exposure Indices, Current Edition

3.0 DEFINITIONS

The following definitions are applicable to this procedure.

Table 1 Acronyms

Term	Description
AIHA	American Industrial Hygiene Association
ACGIH	American Conference of Governmental Industrial Hygienists
CO	Carbon Monoxide
H_2S	Hydrogen Sulfide
MX4 (Ventis)	Industrial Scientific four gas meter with and without pump.
MX6	Industrial Scientific six gas meter with pump.
O_2	Oxygen

Table 1 Acronyms

Term	Description
PID	Photo Ionization Detector. Sensor utilized to measure total hydrocarbon and benzene.
SO_2	Sulfur Dioxide

Table 2 Definitions

Term	Description
Bayesian Analysis	A statistical calculation used to estimate the probability that the true exposure profile falls into a particular exposure control category.
Community Exposure Guidelines (CEG)	Company identified exposure guidelines for potential application to the general public for emergency periods of 10 minutes to 24 hours based primarily on the Environmental Protection Agency (EPA)'s Acute Exposure Guideline Levels (AEGLs). These guidelines address acute exposure limits that would apply immediately or shortly after an incident. They do not address exposure limits for longer time frames (e.g. months to years).
Exposure Assessment Methodology (EXAM)	A comprehensive strategy for the qualitative and quantitative assessment, statistical analysis, addition of controls, and reassessment of occupational exposure risks.
Health Risk Rating (HRR)	An algorithm designed to risk rank a Qualitative Exposure Assessment.
Local Exhaust Ventilation (LEV)	A mechanical system that captures and removes process 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. **Note**: HVAC systems and general ventilation systems are not included in the scope of this document.
Occupational Exposure Limit (OEL)	A company identified exposure limit for a substance derived from the OSHA Permissible Exposure Limit (PEL), ACGIH Threshold Limit Value (TLV), or other sources of exposure criteria developed for the purpose of protecting the health and safety of workers. Corporate Occupational Health maintains the current Occupational Exposure Limits.
Qualitative Exposure Assessment	A method to evaluate and risk rank potential exposures, in the absence of quantitative data, based on the integration of process information, practices and professional judgment.
Quantitative Exposure Assessment	The process of obtaining representative air or noise samples using traditional industrial hygiene and analytical methods.
Similar Exposure Group (SEG)	A group of workers who experience exposures similar enough that assessing the exposures of any member of the group is predictive of exposures of all members of the group.

Table 2 Definitions

Term	Description
Similar Exposure Task (SET)	A task completed by a Similar Exposure Group which: (a) contributes significantly to the long-term average exposure, (b) results in exposures significantly above the composite, and/or (c) results in exposures near or above applicable limits.
Tango (TX1)	Industrial Scientific single gas meter (available for testing CO, H_2S, NO_2, and SO_2), most commonly used for H_2S at Anacortes Refinery.
UltraRae 3000	Photoionization detector utilized for measuring hydrocarbon and benzene.

4.0 ROLES AND RESPONSIBILITIES

4.1 Industrial Hygienist

The Industrial Hygienist maintains overall responsibility for the Anacortes Refinery Industrial Hygiene Program. The Industrial Hygiene Program addresses all chemical, biological, radiological, and physical stressors and concerns or complaints related to worker health which have the potential to adversely impact worker exposure, regulatory compliance, or company assets.

4.2 H&S Department Personnel

Health & Safety Department personnel help conduct periodic industrial hygiene sampling to comply with this procedure.

4.3 Front Line Supervisors

Front Line Supervisors are responsible for ensuring compliance with this procedure.

5.0 EXPOSURE ASSESSMENT AND MONITORING STRATEGY

5.1 Purpose

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.

5.2 Implementation Strategy

Corporate Occupational Health performed an initial baseline assessment of our refinery in November of 2015. Similar Exposure Groups (SEGs) were established using information from operations, maintenance, human resources and historic IH monitoring.

Reassessments and Monitoring Plans are completed annually with support from Corporate Occupational Health.

Table 3 Implementation Milestones

Implementation Milestone (Reference Appendix B)	EXAM Phase	Completion Date
Execute a strategy to complete and maintain **employee** baseline *Qualitative* Exposure Assessments	Qualitative Analysis	11/2015
Execute a strategy to complete **employee** *Quantitative* Exposure Assessments for all HRR Categories 4 & 3 SET's	Quantitative Analysis	Included in Annual Sampling Plans
Execute a strategy to complete and maintain **nested contractor** baseline *Qualitative* Exposure Assessments.	Qualitative Analysis	11/2015
Execute a strategy to complete **nested contractor** *Quantitative* Exposure Assessments for all HRR Categories 4 & 3 SET's	Quantitative Analysis	Included in Annual Sampling Plans
Execute a strategy to complete **employee** and **nested contractor** *Quantitative* Exposure Assessments for all HRR Category 2 SET's	Quantitative Analysis	12/2023
Execute a strategy to complete *Bayesian Analysis* for *Quantitative* Exposure Assessments as required by the MPC Sampling Strategy	Bayesian Analysis	Continuous as sampling completed
Execute a strategy to complete *Reassessments* for all SET's that have had *Bayesian Analysis* completed.	Reassessment	Continuous as Bayesian Analysis completed

5.3 Qualitative/Quantitative Exposure Assessments

5.3.1 Qualitative

Qualitative assessments of potential exposures will be assessed, by each Component, utilizing the MPC Exposure Assessment Methodology (Attachment 1), which includes:

- Determination of Similar Exposure Groups (SEG) for positions with potential exposures.
- Identification of routine and non-routine Similar Exposure Tasks (SET) for each SEG.

Completion of and calculation of a Health Risk Rating (HRR) for each SEG and SET.

5.3.2 Quantitative

Quantitative Exposure Assessments and statistical analysis of potential exposures are completed to ensure statistical validity per the MPC Exposure Assessment Methodology (Attachment 1), which includes:

- Conducting Quantitative Exposure Assessments (industrial hygiene monitoring) using the methods outlined in the MPC IH Measurement Procedures Manual or as designated by an AIHA accredited laboratory.

- Annual Quantitative Exposure Assessment plans will be developed in accordance with the results of the qualitative assessment process and any regulatory required sampling. Additional monitoring will be conducted during emergency situations and during large, non-routine activities such as turnarounds.
- Industrial Hygiene laboratories must be accredited by the American Industrial Hygiene Association.

5.4 Integrating Exposure Assessment Results

The results of the qualitative and quantitative exposure assessments will be used to assign a final risk ranking for each SEG/SET and ensure appropriate control measures are assigned. Bayesian statistical analysis will be used to integrate the assessment results and determine with high accuracy whether the SEG exposure profile can be classified as an Exposure Category 0, 1, 2, 3, or 4, using the EXAM exposure categories (Attachment 2). IH Data Analyst will be used to perform the statistical analysis and assign a category. Results of the analysis will be recorded in the Industrial Hygiene Database. The results of this integrated analysis will determine the applicable control measures.

Table 4 Integrated Exposure Profile Rating and Applicable Controls

Category	Description	Applicable Controls
4	Unacceptable	Engineering Controls PPE Medical Surveillance
3	High	Work Practices PPE Medical Surveillance
2	Moderate	Work Practices
1	Low	Chemical Specific Hazard Communication
0	Minimal	Hazard Communication

5.5 Control Measures

Control measures are established by each component when exposures exceed Occupational Exposure Limits. The following hierarchy of controls will be utilized:

1. Engineering controls, such as substitution with less toxic materials, local and general ventilation to control process gases and vapors, enclosures and mufflers for control of noise, and engineering design for ergonomic stress, will be used as primary methods for reducing employee exposure.
2. Work practice controls, such as restructuring tasks to reduce exposure potential, job rotation, and the use of time-rest regimens.
3. Personal protective equipment (PPE), such as gloves, goggles, enclosing suits, hearing protection, and respiratory protection, are support methods for engineering controls and work practices. The use of PPE will be evaluated on a case-by-case basis and will be validated by formal hazard assessment procedures pursuant to specific governmental regulation and corporate standards. Respiratory protection

procedures will likewise comply with specific governmental regulation and corporate standards.

4. Medical surveillance through the use of chemical specific Health Monitoring Plans is established when engineering controls and work practice controls are not feasible or are unable to reduce exposure levels to within the established limits.
5. Hazard communication is integral part of the industrial hygiene program and is the first line of defense in controlling potential workplace exposures.

5.6 Notifications

Employees will be notified of their monitoring results by letter or by postings in the work area.

Sample results exceeding Occupational Exposure Limits require an individual notification with a corrective action plan distributed to the employee and his/her supervisor. The employee notification letter or email must be signed by the employee as proof of receipt. This document will then be scanned and saved in the corporate Industrial Hygiene database. Note: if sample result exceeded OEL, but appropriate respiratory protection was worn, this should be noted in corrective action plan along with any additional information. Notifications will be distributed in a timely manner and meet the applicable regulatory requirements for substance specific standards (e.g., lead, hexavalent chromium, etc.).

Monitoring results for contract employees will be distributed to the contract company for distribution. All notification letters and result tables will be generated by the Industrial Hygiene Database.

5.7 Recordkeeping

All records associated with this standard and the implementation of this standard shall be inputted into the Industrial Hygiene Database.

6.0 INDUSTRIAL SCIENTIFIC AIR MONITORING EQUIPMENT

Training materials for the operation of the Industrial Scientific MX6, MX4, Tango TX1, and Ultra Rae 3000 monitors are available through the Safety Department and are part of the annual computer-based training (CBT). The SharePoint Industrial Hygiene page also has user guides for the MX6, MX4, AreaRAE and UltraRAE 3000.

6.1 Bump Testing

Employees that utilize any Industrial Scientific air monitoring equipment are required to place the instrument on the docking station daily, with the exception of the "Tango" H2S gas monitor. The docking stations are programmed to know when bump testing and calibration is necessary. All bump testing records are logged onto the iNET Network.

Perform the following steps daily for the functional bump testing and or calibration:

- Check for a green light on the DS2 Docking Station
- Place the gas meter in the DS2 Docking Station. The Docking Station will then go through several steps.

- Yellow light will appear, and display will read the following: discovering, reading instrument settings, updating instrument settings.
- At this point, the DS2 will know if the meter needs to be bumped or calibrated and it will do what is needed, so the display could read "testing" or "calibrating."
- When the test or calibration is finished, the light will turn green if the meter has passed. The yellow light might stay on as well if the battery level needs charging. If this is the case, the display will read "charging."

If you receive a red light, contact a member of the Health & Safety Department or return the instrument to the Safety Equipment Room.

6.2 Calibration

All Industrial Scientific air monitoring equipment is required to be calibrated monthly. The calibration cycle is automatically programmed into the docking stations and will take place when the instrument is docked. All records of calibration are logged into the iNET Network.

Contractors are required to return Anacortes Refinery issued meters at the end of the day to the Safety Equipment Room so that they can be calibrated and charged for use the next day.

6.3 Instrument Alarms

Alarms are pre-programmed into each instrument. The instruments are designed to alarm based on OSHA and industry standards. Both high and low alarms are utilized. A high alarm will have a more "frequent" beep and flash than those of low alarms. The alarm settings are listed below. Alarms can only be adjusted by the Health & Safety Department.

Table 5 Acceptable Alarm Ranges

Sensor	Low Alarm	High Alarm	PEL	STEL *Ceiling	IDLH	Acceptable Range
O_2	19.5	23.5	NA	NA	NA	19.5-23.5
CO	35	70	35	*200	1200	1-35 ppm
H_2S	10	20	10	*50	100	1-10 ppm
SO_2	2.0	4.0	2	5	100	1-2 ppm
PID	50	100	100	NA	NA	1-100 ppm
LEL	10	20	NA	NA	NA	1-10 % LEL

*Indicates that a STEL does not exist, and a NIOSH Ceiling Limit will be used.

6.4 Response to Alarms

Alarms are a critical part of safety management systems, and air monitoring devices are considered lifesaving. Alarms must never be ignored. In the event that a personal alarm (i.e., which resulted from a personal exposure) warns the employee or contractor of a toxic exposure, the individual must immediately leave the area and notify their Supervisor as well as the supervisor of the unit or area that they're in. Alarms resulting from routine monitoring of an area using an MX6 or MX4 with a pump (Ex: sewers, confined space, drain systems) do not need to be reported, unless personal exposure may have occurred. The Health & Safety Department must be notified if exposure may have occurred above the set ceiling or IDLH limits (see Table 5).

6.5 Atmospheric Testing (using MX4 w/pump, MX6 or UltraRae)

Atmospheric Testers will possess the knowledge and skills to be proficient in the instruments' use, limitations and ability to interpret the results. Atmospheric testing must be conducted in a matter that is representative of the atmosphere where work is planned to be performed, be it a confined space or ambient/outdoor area in the vicinity of potential hazards (sewers, drain systems, etc.) In the case of confined spaces, the tester must consider the space configuration and design to ensure representative samples are taken throughout the space or vessel.

When flammable and or toxic concentrations of gas may be present in confined spaces, caution must be taken to ensure the sample is obtained with the use of hoses or extension sampling probes. Pyrophoric hazards must also be considered when those materials are exposed to oxygen upon the opening of vessels or lines.

Continuous monitoring will be conducted in situations where a worker is present in a space where atmospheric conditions have the potential to change.

6.6 Docking Stations

Docking stations are subject to frequent testing performed by iNET. All docking stations are monitored by iNET and repaired/replaced accordingly. The Health & Safety Department will be notified of any issues with the docking stations. The Health & Safety Department will also be responsible for changing calibration gases and diagnosing other problems that arise.

6.7 iNET Database

iNET is a database that maintains and manages all of the Industrial Scientific Equipment. iNET produces weekly and monthly reports for bumping and calibration records. Alarm Reports are also available through iNET. The following diagram illustrates how iNet works:

Figure 1 How Does iNet Work?

7.0 INDUSTRIAL HYGIENE MONITORING

7.1 Colorimetric Tubes

Colorimetric tubes are useful tools when used correctly. Instructions for use are typically specific to the type of tube and manufacturer (i.e.,Sensidyne and Draeger). Accurate results are completely dependent on the user following manufacture directions. The individual conducting the sample should be aware that steam can cause false readings on certain colorimetric tubes.

7.2 AreaRAE

Our AreaRAEs are capable of monitoring for H_2S, LEL, CO, O_2 and VOCs. Remote area monitoring using AreaRAEs is available through the Health & Safety Department. The Health & Safety Department will be responsible for setting up and maintaining such equipment. Remote monitoring equipment is generally used during emergency response type events, and/or during larger maintenance activities/projects. The SharePoint Industrial Hygiene page has a link to the user guide for the AreaRAE.

7.3 Benzene Monitoring

Operations and the Health & Safety Department have been provided with air monitoring equipment (i.e., Ultra Rae 3000) to monitor for benzene. The SharePoint Industrial Hygiene page has the user guide UltraRAE 3000. RAE-SEP tubes for benzene sampling can be picked up in the Safety Equipment Room. A fresh air calibration is performed each time the monitor is turned on. The Tester must ensure that the instrument is turned on in a fresh air environment. The Health & Safety Department will calibrate and maintain these instruments and they can be contacted any time there are questions with the instruments.

7.4 Air Testing for Toxic Materials

Multi-gas meters can accurately detect toxic gases down to 0.1 ppm if calibrated and bump tested frequently. Sensors available to Anacortes Refinery Operations are listed within Table 6.

Table 6 Sensor Detection Levels

Sensor	Level of Detection
Hydrogen Sulfide	0-500 ppm in 0.1 ppm increments
LEL Infrared and Catalytic	0-100% of volume in 1% increments
PID (Hydrocarbon)	0-2000 ppm in 0.1 ppm increments
Sulfur Dioxide	0-150 ppm in 0.1 ppm increments
Carbon Monoxide	0-1500 ppm in 1 ppm increments

7.5 Air Testing for Hazardous Air Particulates & Metals

The Health & Safety Department has the ability to monitor for hazardous particulates and airborne metals (Ex: welding, silica). This type of air sampling is typically performed to ensure ventilation systems are adequate and affected persons are protected. This air monitoring uses a sampling pump, sampling media (filter or cassette), and also requires that the sample be sent off to an outside lab for analysis.

7.6 Noise Monitoring

A sound level meter and personal noise dosimeters may be utilized to gather general baseline data for noise.

7.7 Heat Stress Testing

Heat stress sampling can be accomplished using wet and dry bulb technology (i.e., wet bulb globe monitor). The Health & Safety Department utilizes ACGIH Guidelines for evaluating heat stress.

7.8 Lead Sampling

Lead sampling can be accomplished via swabs or XRF guns. Lead swabs are the quickest and easiest method to determine if the surface or compound has lead containing materials. This method does not provide lead concentrations or exposure limits. XRF guns will provide additional information on concentrations, but they are not immediately available at the Anacortes Refinery. The Health & Safety Department can procure this equipment as needed. Both XRF and lead swabs can only be used for positive verification. A negative result MUST be confirmed using an accredited 3rd party lab.

7.9 Mercury Testing

The Health & Safety Department has the necessary equipment (i.e., Jerome Mercury Vapor Analyzer) to monitor for mercury vapor. Respiratory protection should always be used when mercury vapors are present.

7.10 Interferences & Sensor Poisoning

Table 7 contains a list of known sensor interferences for the Industrial Scientific MX4 and MX6 meters. The most common interferences are from carbon monoxide and hydrogen. A carbon monoxide sensor will give a positive reading in the presence of hydrogen. Hydrogen should be suspected if an instrument is showing elevated CO readings where CO would not typically be present and in units containing hydrogen. Sensors may also be poisoned when exposed to excess gas. It is important to understand the limitations of sensors, and to not expose them to concentrations of gas that exceeds the limitations.

Table 7 MX4 and MX6 Sensor Interferences

	SENSOR											
GAS	Carbon Monoxide	Hydrogen Sulfide	Sulfur Dioxide	Nitrogen Dioxide	Chlorine	Chlorine Dioxide	Hydrogen Cyanide	Hydrogen Chloride	Phosphine	Nitric Oxide	Hydrogen	Ammonia
Carbon Monoxide	100	2	1	0	0	0	0	0	0	0	20	0
Hydrogen Sulfide	10	100	1	-8	-3	-25	400	60	3	10	20	130
Sulfur Dioxide	0	10	100	0	0	0	—	40	—	0	0	70
Nitrogen Dioxide	-20	-20	-100	100	12	—	-120	—	—	30	0	0
Chlorine	-10	-20	-25	90	100	20	-20	6	-10	0	0	-50
Chlorine Dioxide	—	—	—	—	20	100	—	—	—	—	—	—
Hydrogen Cyanide	15	10	50	1	0	0	100	35	1	0	30	5
Hydrogen Chloride	3	0	0	0	2	0	0	100	0	15	0	0
Phosphine	—	—	—	—	—	—	0	300	100	—	—	—
Nitric Oxide	10	1	1	0	—	—	-90	—	—	100	30	50
Hydrogen	60	0.05	0.5	0	0	0	0	0	0	0	100	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	100

The table above reflects the percentage response provided by the sensor listed across the top of the chart when exposed to a known concentration of the target gas listed in the left hand column. Note: This table is given as a guide only and is subject to change.

— No data available

7.11 Combustible Gas Detectors/Sensors

Combustible gas detection instruments measure percentage of the lower explosive limit (LEL), not the percentage of the gas or vapor in the air. LEL is determined by the percent oxygen within the gas mixture. The calculation below demonstrates how the percentage of vapor in air is calculated.

$$\frac{\%\,LEL\ Indicated}{100\%} \times Lower\ Explosive\ Limit\ in\ \% = Actual\ \%\ Gasoline\ Vapor\ in\ Air$$

If the LEL meter reads 15 %, the percentage of gasoline vapor in air is:

$$\frac{15\ \%}{100\ \%} \times 1.3\% = 0.195\ \%\ Actual\ Gasoline\ Vapor\ in\ Air$$

The approximate part per million (ppm) concentration can be calculated by:

$$\%\ gasoline\ vapor\ in\ air \times \frac{10{,}000\ ppm}{1\%} = ppm\ Gasoline\ Vapor\ in\ Air$$

$$0.195\ \% \times \frac{10{,}000\ ppm}{1\%} = 1{,}950\ ppm\ Gasoline\ Vapor\ in\ Air$$

A reading of 100% LEL indicates that enough gasoline vapors are present in the air to support a fire or explosion if an ignition source is also present.

Allow the meter reading to stabilize following exposure to the gas sample before accepting and recording the instrument reading.

7.12 Oxygen

Oxygen readings should always be taken first when testing a work atmosphere. Low oxygen concentrations may prevent the accurate measurement of hydrocarbon gases and vapors by a combustible gas meter. Infrared LEL detectors (MX6) are not affected by low oxygen. Oxygen concentrations below 10% typically are inadequate for accurate LEL measurement. Enriched oxygen atmospheres may cause higher than actual LEL readings.

7.13 Catalytic bead LEL sensors (MX4)

Traditional catalytic bead sensors require oxygen to read correctly. If the oxygen is less than 10%, the LEL sensor will not function correctly, giving a false low reading.

7.14 Infrared LE sensors (MX6)

Infrared LEL sensors can be used in certain low oxygen applications because they do not require oxygen to function correctly. The main drawback to the infrared LEL sensor is that it cannot detect hydrogen as %LEL. If hydrogen has the potential to be present in the monitored area, an elevated CO reading on the meter may be indicative that hydrogen is present.

8.0 COMMUNITY EXPOSURE GUIDELINES AND OCCUPATIONAL EXPOSURE LIMITS

The Anacortes Refinery utilizes the MPC Occupational Exposure Limits (OELs) and Community Exposure Guidelines (CEGs) in order to help protect employees and contractors, and to assist with protecting the community from potential adverse effects due to airborne chemicals during abnormal operating conditions or emergencies.

Community Exposure Guidelines, Occupational Exposure Limits and Air Monitoring Forms can be found in Attachment 3 as well as the MPC path below.

http://ww3.mpcconnect.com/sites/hess-oeh-org/docs/CEGOEL/Forms/Document%20Category.aspx

9.0 LOCAL EXHAUST 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.

9.1 Program Administration

The Anacortes Refinery LEV program is administered by the site Industrial Hygienist. Permanent LEV systems (laboratory fume hoods, canopies, weld shop snorkels) are utilized daily in the refinery to control hazards in the QA Laboratory, Field Laboratories and Welding Shop. Temporary LEV is also a consideration for welding and refractory jobs 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.

9.2 LEV Maintenance

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 laboratory fume hoods, canopies, and 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 laboratory fume hoods, canopies and weld shop snorkels. Recommended hood face velocities range from 80-120 fpm and snorkel capture velocities must be > 50 cfm. Repair recommendations are made based on findings.
- For permanently installed LEV systems used in welding applications and laboratory-style hoods, 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 laboratories as well as 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.

10.0 TRAINING

HES professionals, technicians and contractors performing Qualitative and Quantitative Exposure Assessments should attend the Corporate OEH course on the MPC Exposure Assessment Methodology (EXAM) and Industrial Hygiene Monitoring.

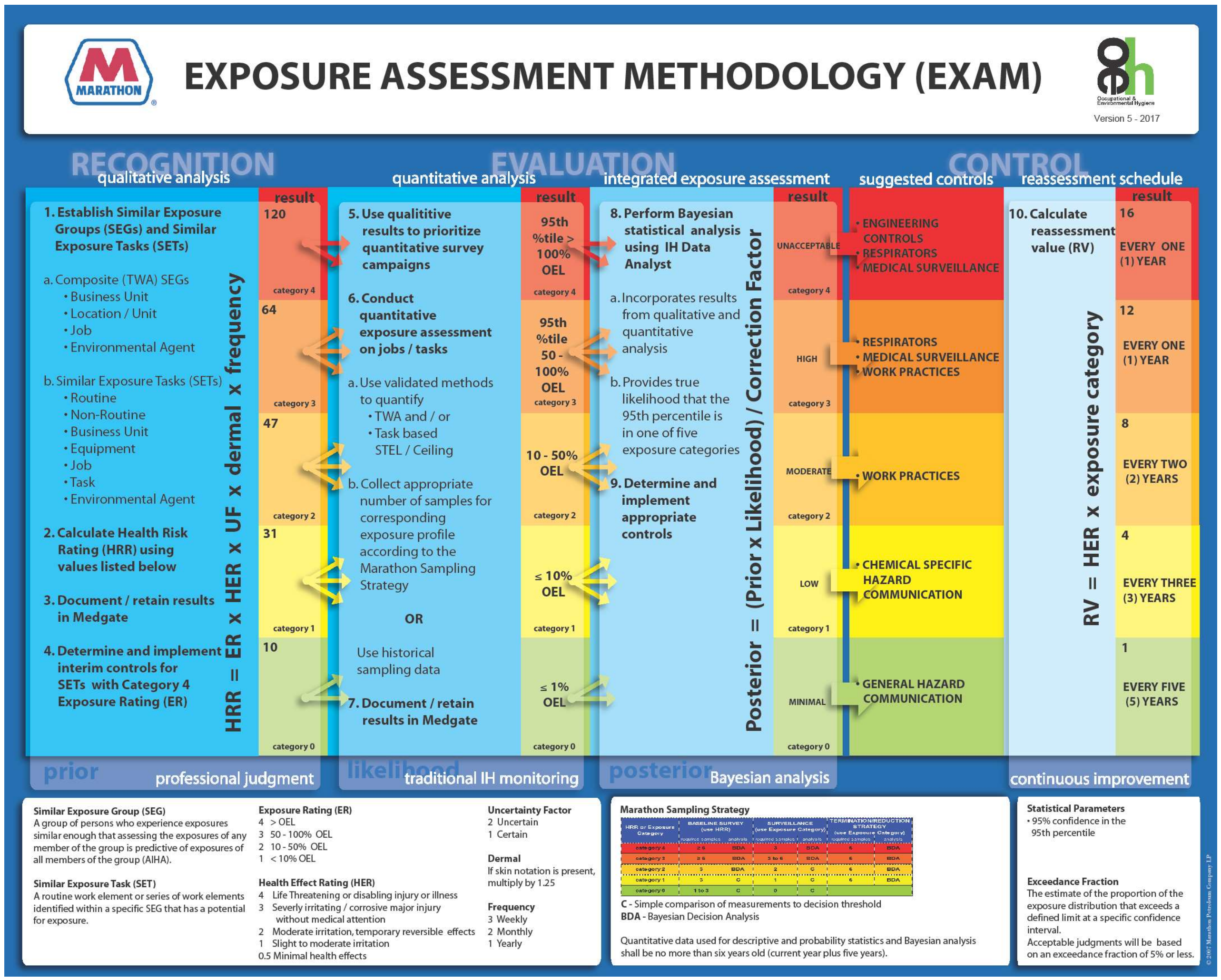
Training on personal air monitoring devices is required annually for all Anacortes Refinery employees.

Contractors must receive the same training through their Company Representative or Contractor Safety Representative. Documentation of this training must be turned into the Health & Safety Department. Training materials and training rosters can be picked up from the Health & Safety Department

11.0 REVIEW AND REVISION HISTORY

Revision #	Preparer	Date	Description
0	Mark Willand	11/7/2021	Reformatted and Numbered per Document Control Policy, R-63-001.

12.0 ATTACHMENT 1 – MPC EXPOSURE ASSESSMENT METHODOLOGY (EXAM)



13.0 ATTACHMENT 2 – MPC SAMPLING STRATEGY

Marathon Sampling Strategy

HRR or Exposure Category	BASELINE SURVEY (use HRR)		SURVEILLANCE (use Exposure Category)		TERMINATION/REDUCTION STRATEGY (use Exposure Category)	
	required samples	analysis	required samples	analysis	required samples	analysis
category 4	≥ 6	BDA	3	BDA	6	BDA
category 3	≥ 6	BDA	3 to 6	BDA	6	BDA
category 2	3	BDA	2	C	6	BDA
category 1	3	C	1	C	6	BDA
category 0	1 to 3	C	0	C		

C - simple comparison of measurements to decision threshold

BDA - Bayesian Statistical Analysis

Quantitative data used for descriptive and probability statistics and Bayesian analysis shall be no less than six years old (current year plus 5 years).

1

14.0 ATTACHMENT 3 – COMMUNITY EXPOSURE GUIDELINES & OCCUPATIONAL EXPOSURE LIMITS

Agent Name	Cas No	MPC Community Exposure Guidelines							MPC Exposure Limit	Notes	Odor Threshold	Location	Measuring Equip
		10 min	30 min	60 min	4 hr	8 hr	24 hr	Re-population					
Ammonia	7664-41-7	30 ppm	30 ppm	30 ppm	30 ppm	30 ppm	30 ppm	< 30 ppm	TWA 25 ppm STEL 35 ppm		5-50 ppm	PTU, VF, Ammonia Scrubber (Strippers), Effluent	Sensidyne Tube and Pump
Asbestos (all forms)	1332-21-4; 12001-29-5; 12172-73-5; 132207-33-1								TWA 0.1 f/cc Excursion 1 f/cc		NA	Refinery Wide	NMAM 7400 - Gilian 5000 and 0.8um MCE cassette, 2 lpm
Asphalt fumes	8052-42-4								TWA 0.5 mg/m3		Low odor threshold (ppb)	ROSE	OSHA 58 - GFF 37mm, 2 lpm
Benzene	71-43-2	130 ppm	73 ppm	52 ppm	18 ppm	9 ppm	2 ppm	< 0.1 ppm	TWA 1 ppm STEL 5 ppm		1.5-4.7 ppm	Crude, Bensat, CR/NHT, Wharf	UltraRAE 3000 or 3M 3520 passive badge
n-Butane	106-97-8	10,000 ppm	6,900 ppm	5,500 ppm	5,500 ppm	5,500 ppm	5,500 ppm	< 1,600 ppm	STEL 1000	C1-C4 Aliphatic Gases	1.2-6.1 ppm	Tank Car Rack, Butamer	OSHA 2010 - ORBO 91 tubes, 0.05 lpm
Carbon dioxide	124-38-9								TWA 5000 ppm STEL 30,000 ppm		No odor	FCCU (Flue Gas Scrubber)	Extech CO2 Analyzer
Carbon monoxide	630-08-0								TWA 25 ppm		No odor	CO Boilers FCCU, (Flue Gas Scrubber)	MX6, AreaRAE
Diesel Fuel	68334-30-5	35-39 ppm	35-39 ppm	35-39 ppm	35-39 ppm	35-39 ppm	35-39 ppm	< 35-39 ppm	TWA 100 mg/m3	0.7 correction factor PID	0.7 ppm	DHT, Day Tank, Truck Rack	NIOSH 1550 - Charcoal Tube, 0.2 lpm
Dimethyl Disulfide	624-92-0								TWA 0.5 ppm		7 ppb	CFH, CR/NHT, DHT	Charcoal Tube, 0.1 lpm
Ethanol	64-17-5	550 ppm	550 ppm	550 ppm	550 ppm	550 ppm	550 ppm	< 550 ppm	STEL 1000 ppm		80 ppm	Ethanol Rack, Ethanol Day Tank	NMAM 1400 - Charcoal Tube, 0.05 lpm
Gasoline	86290-81-5	200 ppm	200 ppm	200 ppm	200 ppm	200 ppm	100 ppm	< 100 ppm	TWA 300 ppm STEL 500 ppm	Gasoline, Similar Products, Intermediate Streams	0.025 ppm	Gas Rec, Gasoline Tanks, Tank, Truck Rack	MX6, AreaRAE, NMAM -1550 - Charcoal Tube, 0.2 lpm
Hydrogen sulfide	7783-06-4	1 ppm	1 ppm	1 ppm	1 ppm	1 ppm	1 ppm	< 1 ppm	TWA 10 ppm STEL 15 ppm		0.008 ppm	Crude, DHT, Treaters, Strippers, FGR, Wharf	MX6, AreaRAE
Isobutane	72-28-5	10,000 ppm	6,900 ppm	5,500 ppm	5,500 ppm	5,500 ppm	5,500 ppm	< 1,600 ppm	STEL 1000	C1-C4 Aliphatic Gases	1.2 ppm	Alky/BI	Sensidyne Tube (113SB) and Pump
Kerosene	8008-20-6	51-59 ppm	51-59 ppm	51-59 ppm	51-59 ppm	51-59 ppm	51-59 ppm	< 51-59 ppm	TWA 200 mg/m3	0.67 correction factor PID	0.1 ppm	Crude, VF, FCCU	NMAM 1550 - Charcoal Tube
Lead Inorganic (as Pb)	7439-92-1								TWA 0.05 mg/m3		No Odor	Old Coatings	NMAM 7300 - MCE PW filter 2 lpm **or** EPA 6010C for paint chips
Mercaptan (Ethyl)	74-93-1	1 ppm	1 ppm	1 ppm	1 ppm	1 ppm	0.5 ppm	< 0.5 ppm	TWA 0.5 ppm Ceil 10 ppm		1.6 ppb	Near propane bullets, Treaters	Sensidyne Tube and Pump or NMAM 2542 (SKA 225-9007 Tube), 0.2 lpm
Nickel carbonyl	13463-39-3								TWA 0.001 ppm CEIL 0.05 ppm		0.5 - 3 ppm	Nickel based catalyst reactors (CR, DHT, NHT)	Nickel Tetracarbonyl Draeger Tubes
Nitrogen dioxide (NO2)	10102-44-0								TWA 0.2 ppm CEIL 5 ppm		0.12 - 0.22 ppm	Flue Gas	Draeger Tubes with accuro pump or OSHA 182 (SKC 226-40-02), 0.2 lpm
Nitrogen oxides (NOX)	10102-43-9								STEL 1 ppm		0.12 - 0.22 ppm	Flue Gas	NMAM 6014 (SKC-226-40), 0.025 lpm
Noise	---								85 dBA		NA	Steam Blows, PSV	3M Noise Dosimeters, 3M Sound Level Meter
Particles NOS (inhalable)									TWA 10 mg/m3		NA	Dust from construction/ demo activities	3M EVM or Gillian 5000 with pre-weighed PVC cassette
Particulate NOS (respirable)									TWA 3 mg/m3		NA	Dust from construction/ demo activities	3M EVM or Gillian 5000 with pre-weighed PVC cassette and aluminum cyclone
Propane	74-98-6	10,000 ppm	6,900 ppm	5,500 ppm	5,500 ppm	5,500 ppm	5,500 ppm	< 1,600 ppm	TWA 1000 ppm	C1-C4 Aliphatic Gases	Unodorized 20,000ppm	Tank Car Rack, Bullets, Gas Rec, Truck Rack	Sensidyne Tube and Pump
Refractory ceramic fibers	142844-00-6								TWA 0.2 f/cc		No Odor	Furnaces and Boilers	NMAM 7400 - Gilian 5000 and 0.8um MCE cassette, 2 lpm
Silica - respirable quartz	14808-60-7								TWA 0.05 mg/m3		No Odor	Refractory Mixing, Chipping, Concrete Cutting	NMAM 7500 - Gilian 5000 Pump and PVC 3-piece Cassette with Aluminum Cyclone
Sulfur dioxide	7446-09-5	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	0.5 ppm	< 0.5 ppm	TWA 0.5 ppm STEL 1 ppm		0.67-4.75 ppm	CO Boilers FCCU, (Flue Gas Scrubber)	MX6
Sulfuric acid	7664-93-9								TWA 0.2 mg/m3		0.25 ppm	Alky Unit	Sensidyne Tube and Pump or OSHA ID-113 with MCE filter, 2 lpm
Toluene	108-88-3	67 ppm	67 ppm	67 ppm	67 ppm	67 ppm	67 ppm	< 67 ppm	TWA 20 ppm, CEIL 300 ppm		8 ppm	Lab and Refinery Wide	3M 3520 passive badge
Total Organic Vapors (as n-Hexane)									TWA 100 ppm STEL 150 ppm			Refinery Wide	MX6, Area RAE or 3M 3520 passive badge
Xylene	1330-20-7	130 ppm	130 ppm	130 ppm	130 ppm	130 ppm	130 ppm	< 130 ppm	TWA 100 ppm STEL 150 ppm		1 ppm	Lab and Refinery Wide	3M 3520 passive badge