

Preliminary Draft Refinery Fenceline Air Monitoring Plan Guidelines - August 2023

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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Diamond Bar, California

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1. Background

The South Coast Air Quality Management District (South Coast AQMD) Governing Board ~~adopted~~ amended Rule 1180 – Petroleum Refinery Fenceline and Community Air Monitoring (Rule 1180) and adopted Rule 1180.1 – Other Refinery Fenceline and Community Air Monitoring (Rule 1180.1) on November 3, 2023. ~~(date of adoption)~~—The main purpose of Rule 1180 and Rule 1180.1 is to require real-time fenceline air monitoring systems and to establish a fee schedule to fund refinery-related community air monitoring systems that provide air quality information to the public and local response agencies about levels of various criteria air pollutants, volatile organic compounds and other compounds at or near the property boundaries of ~~petroleum~~ refineries.

Rules 1180 and 1180.1 requires that refinery ~~operator~~owner or operators submit a written ~~f~~Air monitoring ~~p~~lan (~~air monitoring plan~~FAMP) for establishing and operating a real-time fenceline air monitoring system. ~~Therefore,~~South Coast AQMD staff developed ~~this~~the Rule 1180—Refinery Fenceline Air Monitoring Plan Guidelines (Guidelines) document as a written framework to be used by the Executive Officer to evaluate FAMPs ~~air monitoring plans~~ required by Rules 1180 and 1180.1.

By design, these Guidelines will inform petroleum refinery ~~operator~~owner or operators subject to ~~the~~Rules 1180 and 1180.1 about the elements necessary to complete an ~~air monitoring plan~~FAMP. ~~South Coast AQMD~~ recognizes the need for flexibility when designing an ~~air monitoring plan~~FAMP; therefore, each plan will be evaluated on a case-by-case basis and tailored to each facility's size, operations, specific location, and ~~its~~ surrounding receptors. ~~Therefore,~~a fenceline air monitoring system must be representative of the size of the affected facility and its emissions and must achieve adequate coverage along the entire refinery fenceline. Rule 1180.1 is similar to Rule 1180 for air monitoring requirements; therefore, staff revised Rule 1180 Guidelines to include guidelines for Rule 1180.1 and criteria that would be used to allow the exclusion of certain types of monitoring.

~~A fundamental requirement of~~ Rules 1180 and 1180.1 is requires that a FAMPs and QAPPs to fenceline air monitoring plan must provide detailed information about the installation, operation, and maintenance, and quality assurance and quality control (QA/QC) of a fenceline air monitoring system. A fenceline air monitoring system is defined as a combination of equipment that measures and records air pollutant concentrations at or near the property boundary of a ~~petroleum~~ refinery. An effective fenceline air monitoring system ~~should~~shall be capable of measuring routine emissions ~~from refineries~~ and detecting leaks, as well as unplanned releases from refinery equipment and other sources of refinery-related emissions. For this purpose, fenceline air monitoring system must cover the entire refinery fenceline, whenever feasible. The fenceline air monitoring system would inform refinery operators and the public about potential air pollution impacts ~~to nearby communities from refinery operations~~. The following diagram (Figure 1) outlines the refinery fenceline program. Each of the parts will be discussed in this guidance document.

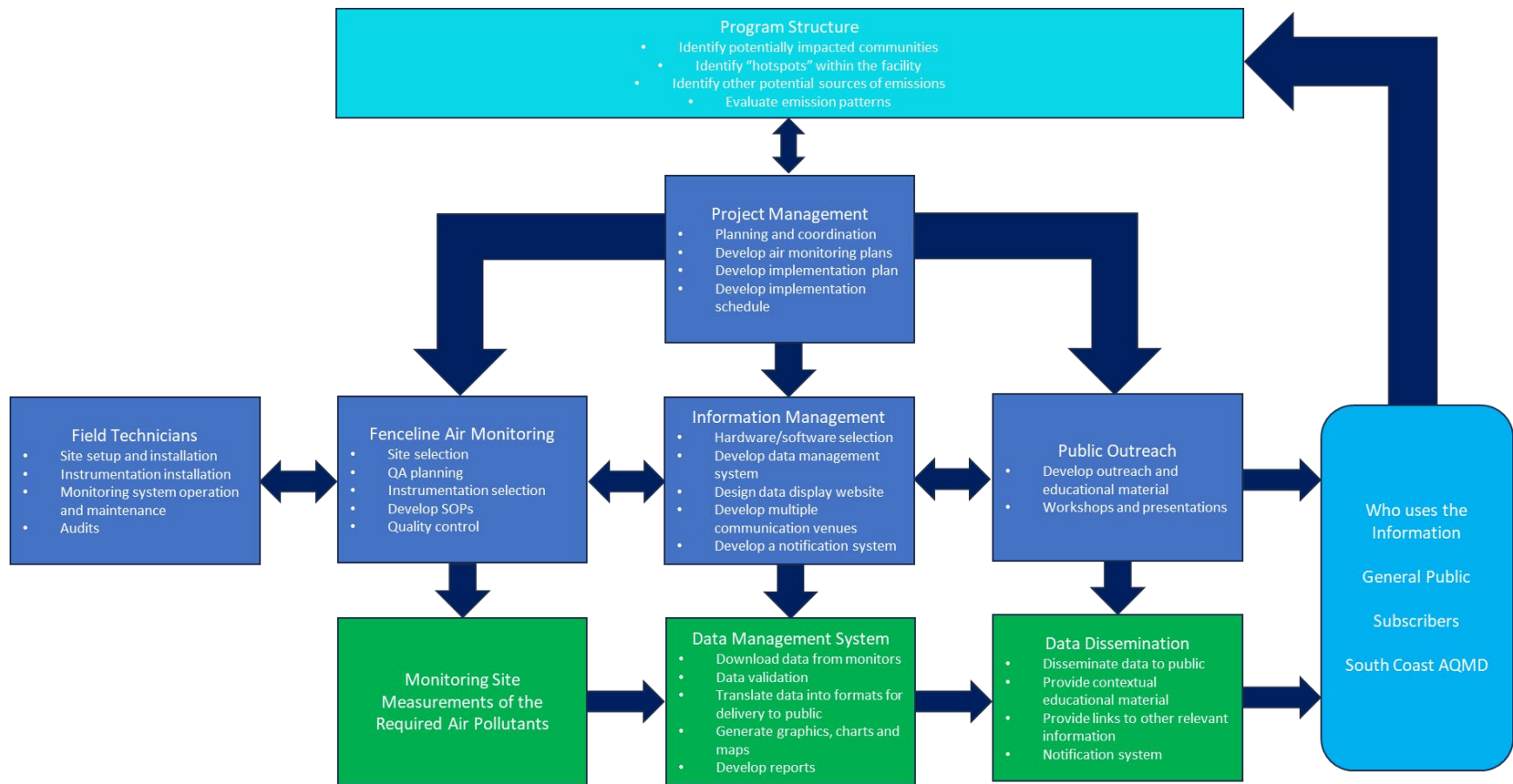
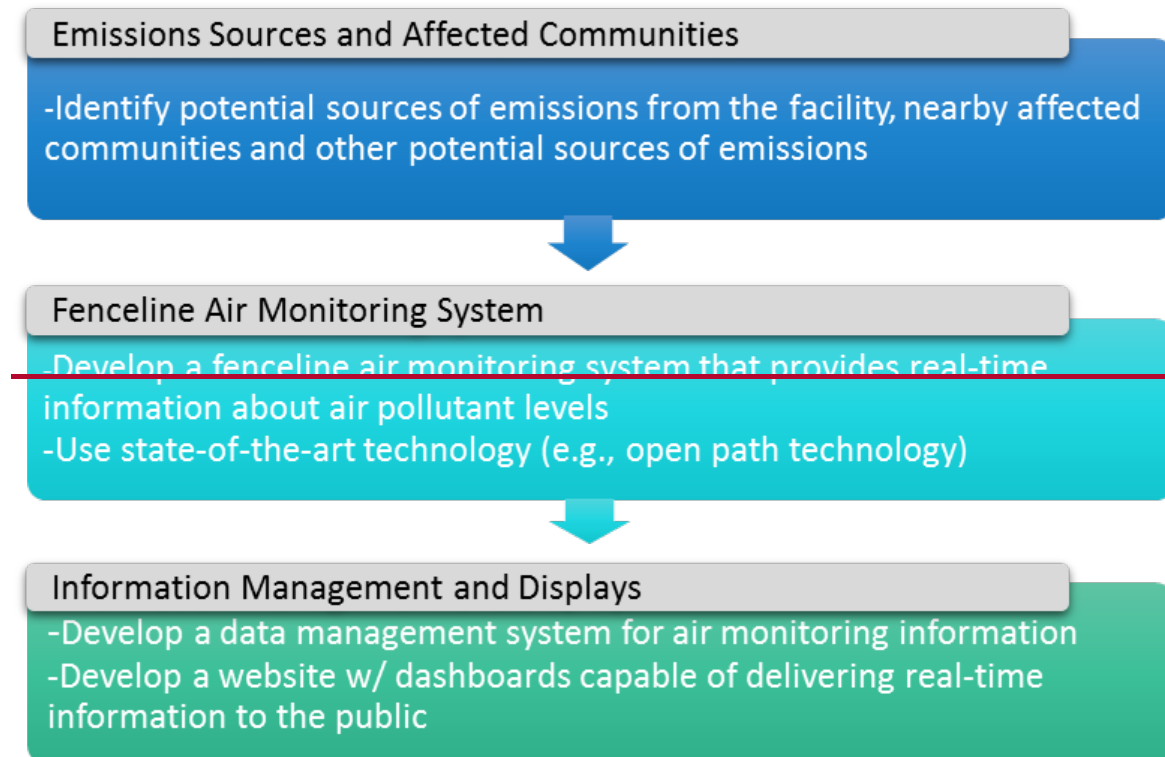


Figure 1: Overview of the Refinery Fenceline Air Monitoring Programs

2. Fenceline Air Monitoring Plan

~~Developing an air monitoring plan requires three important steps;~~ There are three main steps in developing a FAMP: (1) identifying emissions sources and affected communities, (2) developing ~~deriving~~ a fenceline air monitoring system that can provide real-time information about certain air pollutant levels, and (3) effectively communicating this information using data management technology and displays. The below diagram (Figure ~~12~~ - Overview of Key Steps to Developing an Air Monitoring Plan FAMP), ~~below~~ outlines these steps ~~important considerations for developing a fenceline air monitoring system.~~



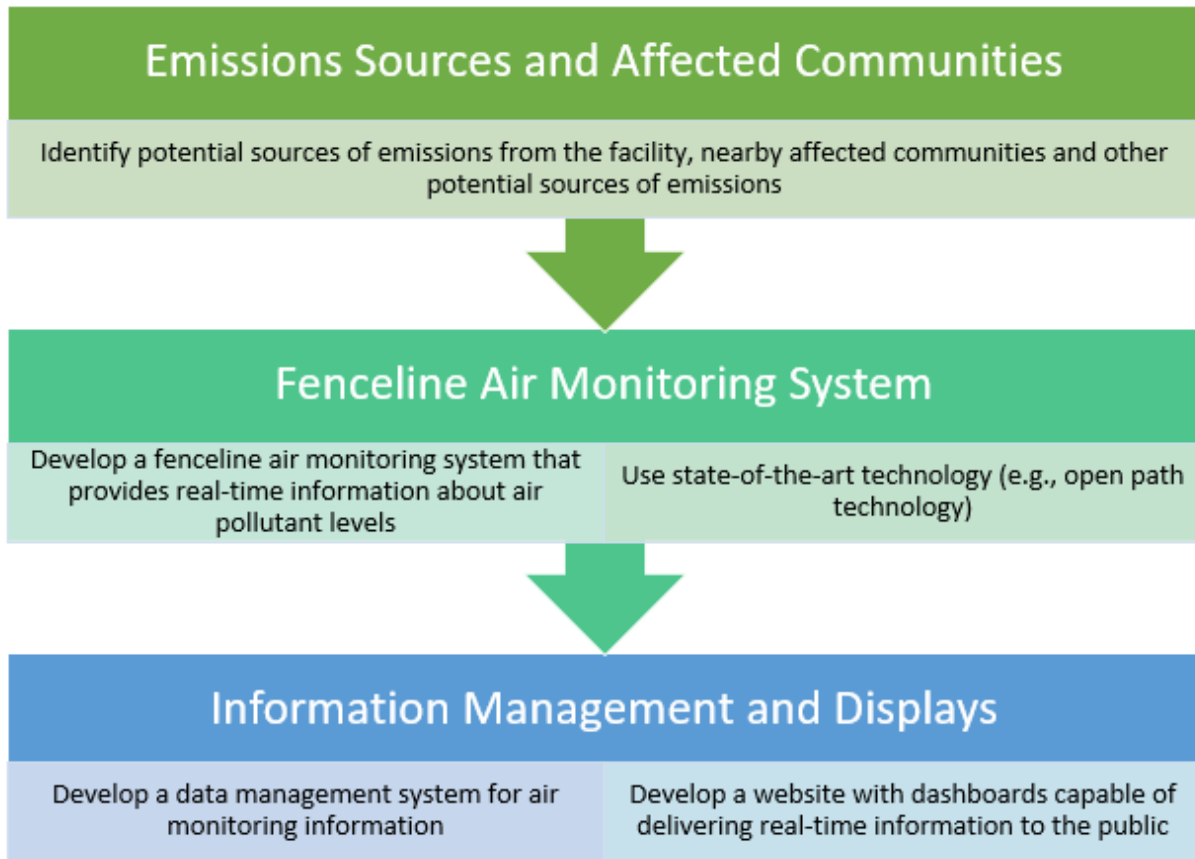


Figure 2: Overview of Key Steps to Developing a FAMP

An ~~an~~ **approvable** [FAMP](#) shall meet the following key objectives:

- Provide information about various air pollutant levels (i.e., determined by air pollutant concentration) measured in real-time ([when feasible](#)) ~~in durations~~ and short enough [time resolution](#) to adequately address significant emissions changes from refinery operations;
- Gather accurate air quality and meteorological data to identify ~~both the time(s) and location(s)~~ [factors that may impact](#) ~~of various~~ air pollutant levels near refinery operations ~~and provide a comparison of these levels to other pollutant levels monitored in the Basin;~~
- Track long-term air pollutant levels, variations, and trends over time at or near the property boundaries of ~~petroleum~~-refineries ~~and in nearby communities;~~
- Provide context to the data so that local communities can distinguish air quality in their location from other locations in the Basin and understand the potential health impacts associated with local air quality near ~~petroleum~~-refinery operations;
- [Notify subscribers](#) ~~Provide a notification system for communities near refineries~~-when emissions exceed [pre-determined](#) thresholds (e.g., [reference exposure levels \(REs\)](#) [or other relevant health-based standards, whichever is lower](#)); and

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- Provide quarterly reports summarizing the measurements, data completeness, and quality assurance.

Rules 1180 and 1180.1 set forth requirements for ~~air monitoring plan~~ FAMPs and QAPPs. Please see Appendix A for Fenceline Air Monitoring Plan Checklist. The ~~air monitoring plan~~ FAMP shall include details of ~~detailed information for the following~~ the following:

- An evaluation of routine emission sources at the refinery (e.g., utilizing remote sensing or other measurement techniques or modeling studies, such as those used for health risk assessments);
- An analysis of the distribution of operations and processes within the refinery to determine potential emission sources;
- An assessment of air pollutant distribution in surrounding communities (e.g., mobile surveys, gradient measurements, and/or modeling studies used for health risk assessments);
- A summary of fenceline air monitoring instruments and ancillary equipment that are proposed to continuously measure, monitor, record, and report air pollutant levels in real-time near the petroleum refinery facility perimeter (i.e., fenceline);
- A summary of instrument specifications, detectable pollutants, minimum and maximum detection limits for all air monitoring instruments;
- Proposed monitoring equipment siting and selected pathways (when applicable) for fenceline instruments, including the justification for selecting specific locations based on the assessments mentioned above;
- Operation and maintenance requirements for the proposed monitoring systems;
- An implementation schedule consistent with the requirements of Rules 1180 and 1180.1;
- Procedures for implementing quality assurance and quality control of data;
- A web-based system for disseminating information collected by the fenceline air monitoring system;
- Alternative methods of accessing data, periodic reports, and notification for those members of the community who may not have internet access (e.g., automated phone systems for dial-in information, public displays, printed copies of periodic reports in libraries or community centers, information in other languages as needed, etc.);
- Details of the proposed public notification system; and
- Independent audit ~~Demonstration of independent oversight~~.

This information will ~~assist the Executive Officer in determining~~ be used by the Executive Officer to determine ~~the approval status of an~~ whether to approve the ~~air monitoring plan~~ FAMP and QAPP during the plan review process ~~required by~~ set forth in ~~paragraph (f) of~~ Rules 1180 and 1180.1.

3. Fenceline Air Monitoring Systems

Pursuant to the requirements of Rules [1180](#) and [1180.1](#) discussed above, development of a fenceline air monitoring system shall ~~take into account~~ [consider the](#) geospatial layout of the refinery site, potential release sources, local meteorology, atmospheric dispersion characteristics of the compounds of concern, the relative risk to likely receptors based on these criteria, and other considerations ~~outlined below~~. [Fenceline air monitoring systems should achieve maximum possible fenceline coverage, whenever feasible.](#)

Fenceline Air Monitoring Plan Checklist	
Fenceline Air Monitoring Coverage (or Spatial Coverage)	
R	Identify the facility's proximity to sensitive receptors affected by the refinery operation and provide the information below:
	○ Distance from facility to closest sensitive receptor(s)
	○ Location of downwind and upwind communities
	○ Eminent sources of non-refinery emissions surrounding the facility (e.g. non-refinery industrial facilities)
	○ Dispersion modeling [‡]
R	Describe historical facility emission patterns and pollutant hotspots based on the following:
	○ On-site location of operations and processes within the facility's perimeter
	○ On-site location of emissions sources and level of emissions
	○ Facility plot plans and topography
	○ Dispersion modeling [‡]
R	Select sampling locations along the perimeter of the facility based on the information above. Also, provide the following:
	○ Locations where equipment will be sited (e.g., GIS coordinates) and measurement pathways
	○ Elevations of equipment and pathways
	○ A description of how the monitoring system will cover all nearby downwind communities
Fenceline Air Monitoring Equipment Description	
R	Select open-path air monitoring equipment that is capable of continuously measuring air pollutants in real time and provide the following:

	<ul style="list-style-type: none"> ○ Specifications for the open path instruments (e.g., detection limits, time resolution, etc.)
	<ul style="list-style-type: none"> ○ Explanation of the operation and maintenance requirements for selected equipment
	<ul style="list-style-type: none"> ○ Substantiate any request to use alternative technologies
R	Monitor for the pollutants listed in Table 1 of Rule 1180 and include the following:
	<ul style="list-style-type: none"> ○ Specify pollutant detection limits for all instruments and paths measured
	<ul style="list-style-type: none"> ○ Substantiate any exclusion of chemical compounds listed in Table 1 of Rule 1180 or the use of an alternative air monitoring technology
Quality Assurance	
R	Develop a Quality Assurance Project Plan (QAPP) that describes the following:
	<ul style="list-style-type: none"> ○ Quality assurance procedures for data generated by the fenceline air monitoring system (e.g. procedures for assessment, verification and validation data)
	<ul style="list-style-type: none"> ○ Standard operating procedures (SOP) for all measurement equipment
	<ul style="list-style-type: none"> ○ Routine equipment and data audits
Data Presentation to the Public	
R	Design a data display website that includes the following:
	<ul style="list-style-type: none"> ○ Educational material that describes the objectives and capabilities of the fenceline air monitoring system
	<ul style="list-style-type: none"> ○ A description of all pollutants measured and measurement techniques
	<ul style="list-style-type: none"> ○ A description of background levels for all pollutants measured and provide context to levels measured at the fenceline
	<ul style="list-style-type: none"> ○ Procedures to upload the data and ensure quality control
	<ul style="list-style-type: none"> ○ Definition of QC flags
	<ul style="list-style-type: none"> ○ Hyperlinks to relevant sources of information
	<ul style="list-style-type: none"> ○ A means for the public to provide comments and feedback; Procedures to respond
	<ul style="list-style-type: none"> ○ Archived data that with data quality flags, explains changes due to QA/QC and provides chain of custody information

	<ul style="list-style-type: none"> Quarterly data summary reports, including relationship to health thresholds, data completeness, instrument issues, and quality control efforts
Notification System	
<input checked="" type="checkbox"/>	Design a notification system for the public to voluntarily participate in that includes the following:
	<ul style="list-style-type: none"> Notifications for activities that could affect the fenceline air monitoring system (e.g., planned maintenance activities or equipment failures)
	<ul style="list-style-type: none"> Notifications for the availability of periodic reports that inform the community about the air and provide updates on the performance and maintenance of the fenceline air monitoring system
	<ul style="list-style-type: none"> Triggers for exceedances in thresholds (e.g. Acute Reference Exposure Levels (RELS))
	<ul style="list-style-type: none"> Communication methods for notifications, such as, website, mobile applications, automated emails/text messages and social media

‡Dispersion modeling shall be conducted using U.S. EPA’s Preferred and Recommended Air Quality Dispersion Model (e.g., Health Risk Assessment)

Details about each of these key considerations are explained below.

a. Multi-Pollutant Monitoring

[The purpose of Rules 1180 and 1180.1 is to provide air quality information to the public on levels of various criteria air pollutants, volatile organic compounds, metals, and other air pollutants, at or near the property boundaries of petroleum refineries and in nearby communities.](#) Multi-pollutant monitoring [can be beneficial as they can provide air quality information for multiple air pollutants and therefore, can](#) ~~is a means to~~ broaden the understanding of air quality conditions and pollutant interactions, further ~~the~~ing capabilities ~~of~~to evaluating air quality models, develop emissions control strategies, and support research, ~~including (i.e., health studies)~~. Petroleum refineries and activities associated with them emit a wide range of air pollutants, including criteria pollutants (SO₂, NO_x, CO, and PM); volatile organic compounds (VOCs), including photochemically reactive VOCs that contribute to formation of tropospheric ozone (e.g., ethylbenzene, formaldehyde); carcinogenic hazardous air pollutants (e.g., benzene, 1,3-butadiene, naphthalene, polycyclic aromatic hydrocarbons, formaldehyde); non-carcinogenic air toxics (hydrogen fluoride, hydrogen cyanide); persistent bio-accumulative toxics (mercury), [air toxic metals \(e.g., at a minimum nickel, cadmium, manganese\)](#) and other air pollutants (e.g., hydrogen sulfide, ~~and~~ carbonyl sulfide, ~~and~~ particulate matter).

Chemical compounds associated with health risk and those measured at other ambient air monitoring locations ~~should~~shall be identified in the ~~air monitoring plan~~FAMPs. ~~Identification of the health risk drivers can be informed by the health risk assessment studies performed at the refineries, as well as other information regarding potential health risk near refineries.~~Exclusion of any of these chemical compounds identified in Table 1 must be thoroughly explained and

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justified ~~within~~ in the Facility's ~~the air monitoring plan (FAMP).~~ Other chemicals may also be inherently monitored by the fenceline air monitoring systems (e.g., Ozone by the open path optical remote sensing analyzers) and may be included in the reporting for additional public information.

~~Additional chemicals may be of interest to monitor as a part of the fenceline air monitoring system, for example, if certain annual emissions exceed 10,000 lbs/year. Other chemicals may also be inherently monitored by the open path systems and may be included in the reporting for additional public information.~~

b. Chemical Species of Interest

The California Environmental Protection Agency's (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) is collaborating with the California Air Resources Board (CARB) and the Interagency Refinery Task Force to identify and develop information on chemicals emitted from refineries and their health effects in order to assist air agencies in developing plans for air monitoring at refineries in California. OEHHA and CalEPA published ~~a the draft report¹ in September 2017~~ report² in March 2019, which ~~that~~ presents a comprehensive list of chemicals emitted from California refineries, including emissions that occur routinely in daily operations, as well as accidental and other non-routine emissions [1]. The list prioritizes the chemicals according to their emissions levels and toxicity, providing a list of chemicals that would be top candidates for air monitoring near refineries according to the volume of the chemicals emitted and their toxicity. The presence of a chemical on this comprehensive list does not necessarily mean it is released from all refineries, at all times, or in significant quantities.

The potential compounds emitted from refineries that pose the highest health risk in nearby communities ~~should~~ shall be identified along with the appropriate monitoring technologies selected to measure them. This assessment should be informed by the OEHHA report on Refinery Chemical Emissions and Health Effects Report. The chemical compounds of interest for Rules 1180 and 1180.1 are presented in Table 1 below; however, the metal compounds are not required to be monitored by Rule 1180.1 refineries.

~~The petroleum refinery air monitoring plan must explain exclusion or replacement of monitoring for any of the compounds identified in Table 1 below. For example, in certain instances a petroleum refinery operator may propose to exclude monitoring for specific compounds that are not likely to be measured at or above the detection limits of the fenceline air monitoring equipment. In these instance, the petroleum refinery operator would be required to provide an alternative measurement methodology or evidence (e.g., historical air monitoring data or operational information) to support the proposed exclusion. A petroleum refinery may submit a~~

~~Analysis of Refinery Chemical Emissions and Health Effects Report. September 27, 2017 (<https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport092717.pdf>)~~

[1] OEHHA, "Analysis of Refinery Chemical Emissions and Health Effects," March 2019. [Online]. Available: <https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf>.

~~revised fenceline air monitoring plan if changes to the fenceline air monitoring system are supported based on new information.~~

Table 1 - Refinery-Related Air Pollutants to be Addressed by ~~Fenceline Air Monitoring Plan~~FAMPs

Air Pollutants
Criteria Air Pollutants
—Sulfur Dioxide
—Nitrogen Oxides
<u>Particulate Matter</u>
Volatile Organic Compounds
—Total VOCs (Non-Methane Hydrocarbons)
—Formaldehyde
—Acetaldehyde
—Acrolein
—1,3-Butadiene
<u>Naphthalene</u>
<u>Polycyclic aromatic hydrocarbons</u>
—Styrene
<u>Benzene</u>
<u>Toluene</u>
<u>Ethylbenzene</u>
—BTEX Compounds (Benzene, Toluene, Ethylbenzene, Xylenes)
<u>Metals</u>*
<u>Cadmium</u>
<u>Manganese</u>
<u>Nickel</u>
Other Compounds
—Hydrogen Sulfide
—Carbonyl Sulfide
—Ammonia
—Black Carbon*
—Hydrogen Cyanide
Hydrogen Fluoride ⁺

[*Not required in Rule 1180.1](#)

⁺ If the facility uses hydrogen fluoride.

Sulfur Dioxide (SO₂)

Heating and burning of fossil fuel releases the sulfur present in these materials and result in the formation of SO₂. SO₂ is the criteria pollutant that is the indicator of SO_x concentrations in the ambient air and can have direct health impacts and can cause damage to the environment. As a result, SO₂ is routinely measured in ambient air monitoring networks. The major sources of SO₂ at refineries are fuel fired in furnaces and boilers, [Fluid Catalytic Cracking units \(FCCUs\) units](#), Sulphur Recovery Units, flares, etc. As a result, measurement of this compound will help identify potential contribution of refineries to the ambient concentrations [of SO_x](#) in nearby communities.

Nitrogen Oxides (NO_x)

Both gasoline and ~~diesel-powered~~ [diesel-powered](#) vehicles are the main source of NO_x emissions; however, substantial emissions are also added by stationary sources such as ~~petroleum~~ refineries. Nitrogen oxides is a group of highly reactive gases that contribute to the formation of secondary ~~particles~~ [particulate matter](#), as well as tropospheric ozone. Scientific evidence links NO₂ exposures with adverse respiratory effects and is one of the criteria pollutants, making it a compound that is routinely measured in ambient air monitoring networks. NO₂ measurements also typically include measurement of NO and NO_x. Measurement of these constituents will help determine if refineries add significant concentrations [of NO_x](#) to nearby urban environments.

Particulate Matter (PM₁₀ and PM_{2.5})

[Particulate matter \(PM\) is a mixture of liquid droplets and solids such as dust, dirt, soot, and smoke in the air. These particles exist in a large variety of shapes, sizes, and chemical compositions. Fine particles commonly contain ionic species \(e.g., sulfate, nitrate, and ammonium\), acid \(e.g., hydrogen ion, H⁺\), organic and elemental carbon, and trace elements \(e.g., aluminum, silicon, sulfur, chlorine, potassium, calcium, titanium, vanadium, chromium, manganese, nickel, copper, zinc, selenium, bromine, arsenic, cadmium, and lead\). PM_{2.5} can also contain larger amounts of polycyclic aromatic hydrocarbons \(PAHs\) such as naphthalene, chrysene, phenanthrene, and anthracene than PM₁₀.](#)

[Particulates have been detected at many emissions points in refineries \(abrasive blasting, asbestos abatement, boilers, cooling towers, crude units, heaters, cokers, FCCUs, incinerators, and flares\) and in non-routine emissions outdoors.](#)

[There are point monitors for particulate matter which employ methods such as beta attenuation, light scattering/absorption, and tapered element oscillating microbalance. These instruments range from hourly to minute averages and cover a range of PM types including PM_{2.5}, PM₁₀, and speciated particulate matter. Real-time PM monitoring instruments and methods are in use throughout regulatory air monitoring networks.](#)

Volatile Organic Compounds (VOCs)

VOCs include non-methane hydrocarbons (NMHC) and oxygenated NMHC such as alcohols, aldehydes, and organic acids. They are emitted by a large number of sources, but many hydrocarbons are associated with fuels and the production of fuels. VOCs, mainly hydrocarbons,

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originate from production processes, storage tanks, transport pipelines and waste areas. As a result, measurement of these compounds is critical to determine the impacts that refineries have on nearby communities. While measurements of NMHC could provide valuable information about potential refinery emissions, for a refinery it is possible to distinguish a few and well-defined number of specified VOCs to represent refinery fugitive emissions and/or health risk drivers. Measurement of these specified VOCs must be carried out continuously, using open-path [UV-DOAS and FTIR](#) technologies at the fenceline of the refineries.

~~Unless it is demonstrated in the fenceline air monitoring plan that an alternative measurement technique (e.g. point monitors) can be effectively utilized.~~ Automated gas chromatographs (Auto-GCs) ~~is the best point monitor option to measure~~ [offer sub-ppb sensitivity for monitoring of select VOCs pollutant concentrations semi-continuously \(for example, hourly time resolution, with data for previous hour being available within 15-20 minutes past the hour\).](#) ~~at a monitoring site.~~ This technology has been developed by ~~a number of several~~ manufacturers. ~~The~~ and U.S. EPA has ~~ve~~ evaluated current state and availability of several commercially available auto-GCs in order to determine their suitability for use in air monitoring stations and has ~~ve~~ published the results in the Photochemical Air Monitoring Station (PAMS) Gas Chromatography Evaluation Study Report [2]³. Other [emerging](#) methods for continuous measurement of ~~selected~~ [specified](#) VOCs include, but [are](#) not limited to, in-situ [DOAS and FTIR](#) ~~optical analyzers, systems and quantum cascade laser~~ [These](#) instruments ~~that can effectively measure~~ [can reliably measure](#) selected VOCs simultaneously with high time resolution [\(e.g. 1 minute or less\), but with higher detection limits, compared to Auto-GCs.](#) ~~The use of these measurement techniques can potentially provide real time and continuous air quality data, however~~ [However](#), a substantial number [of these Auto-GCs and/or of auto-GC units \(or other point monitors\)](#) would need to be deployed to achieve sufficient spatial coverage along the property boundary or fenceline of a ~~petroleum~~ refinery. [For this reason, application on open-path technologies for fenceline air monitoring of VOCs at refinery fencelines is preferred.](#)

~~In some cases, more traditional measurement techniques could be utilized, if the air monitoring plan successfully demonstrates the effectiveness of the measurement technique. For example, VOCs could be measured by the collection of ambient air using evacuated canister sampling and subsequent analysis on a gas chromatograph (GC). This method relies on acquiring air samples which may take a that often require a considerable amount of time depending on the measured concentrations (e.g., several hours with canisters to several days with adsorption cartridges) and subsequent chemical analysis in a certified laboratory. The sample collection time can vary from instantaneous grab samples to averaging times of 24 hours. If this sampling technique is selected, periodic 24 hour samples (e.g., 1 in 6 days) and instantaneous grab samples (e.g., 5 or 10 minute samples) that are triggered by elevated readings of continuous NMHC are required. The~~

³ RTI (2014). Gas Chromatograph (GC) Evaluation Study: Laboratory Evaluation Phase Report. Prepared for U.S. EPA PAMS Program. [<https://www3.epa.gov/ttnamti1/files/ambient/pams/labevalreport.pdf>]

[2] RTI International and EC/R Incorporated, "Gas Chromatograph (GC) Evaluation Study," 2014.

~~continuous NMHC measurement must achieve the temporal and spatial coverage requirements of the rule, while the periodic and triggered samples will provide information on the speciation of the measured VOCs.~~

Measurement of hydrocarbons will help determine if refineries add significant concentrations to nearby urban environments and can indicate leaks and emissions from refinery sources. The ~~following are~~ potential compounds of interest and [techniques to measure and/or analyze them are described below.](#) ~~are separated out based on their measurement and/or analytical techniques.~~

Aldehydes

Aldehydes emitted into ambient air include, but are not limited to, formaldehyde, acetaldehyde, and acrolein that are identified as toxic air contaminants (TACs) and could be emitted from a refinery. These compounds are the products of incomplete combustion of natural gas and are both precursors of atmospheric radicals that accelerate the formation of ozone and toxic air pollutants that may cause respiratory symptoms and cancer. These compounds could be measured continuously at the fenceline of the refineries using open-path technologies. A more detailed listing of aldehydes with potential health concerns is provided by OEHHA.

Aromatic Hydrocarbons

Some of the aromatic hydrocarbons known as BTEX (referring to benzene, toluene, ethylbenzene, and xylenes) occur naturally in crude oil and are associated with emissions from ~~petroleum~~ refineries. The BTEX compounds are products of incomplete combustion of natural gas, and also fugitive emissions from petroleum storage and transfer. Emissions also occur from different combustion sources, such as wood combustion, and stationary and motor vehicle fossil fuel combustion, ~~and elevated levels of BTEX compounds are expected in vicinity of major roadways.~~ This group of aromatic VOCs are important because not only they pose risk to human health, ~~but~~ they also play a role in formation of tropospheric ozone.

Analytical methods for BTEX compounds in air include absorption traps and subsequent separation by gas chromatography (GC) with detection by flame ionization optical absorption or mass chromatography, ~~as well as~~ automatic-GC monitors. Optical methods such as ~~UV-DOAS and OP-FTIR monitors are more advanced techniques for measurement;~~ however, UV-DOAS instruments are ~~particularly more sensitive at in-detecting~~ of BTEX compounds at low concentrations ~~and with good time resolution~~ compared to OP-FTIR instruments.

Other Hazardous Air Pollutant VOCs

Other VOC air toxics of concern that are often reported in refineries' emission inventories include 1,3-butadiene and styrene that have been detected in routine and non-routine refinery emissions and therefore must be measured and reported. A more detailed listing of potential VOCs ~~with potential~~ of health concerns is provided by the OEHHA and the AB 2588 Health Risk Assessment reports that will help inform other toxics specific to each facility. Depending on emissions from each facility, measurement of other VOC air toxics may be appropriate. Such VOC compounds

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include, but are not limited to, methanol, phenol, naphthalene, and hexane. For example, the plan could include a requirement that these toxic gases shall be monitored and reported, if the emissions exceed a certain amount each year ~~10,000 lbs/year~~ and/or selected monitoring technologies are capable of detecting them.

Naphthalene

Naphthalene is a volatile white crystalline solid that exists in air in the form of vapor or adsorbed to particulates. It is released into the atmosphere from coal and oil combustion and from the use of mothballs. Naphthalene emissions have been detected at several refinery process units (separators, boilers, cooling towers, crude units, heaters, storage tanks, cokers, FCCUs, wastewater treatment, incinerators, and vents) and naphthalene has been detected in both routine and non-routine emissions. Open Path UV-DOAS instruments currently installed at the refineries for fenceline air monitoring are capable of monitoring naphthalene.

Diethanolamine

Diethanolamine is a hydrocarbon found in air, water vapor, and particulate phases. In refineries, diethanolamine has been detected at multiple refinery process units. Diethanolamine can be determined in air by drawing the air sample through sampling tubes for analysis with chromatography. However, diethanolamine has tendencies to absorb water and to supercool. (Supercooling is a process of lowering the temperature of a liquid below its freezing point without it becoming a solid.) As a result, diethanolamine has a short-lived gaseous phase. Due to the nature of the compound, it would not remain in the vapor state long enough to be transported to the fenceline. For this reason, refineries will not be required to measure diethanolamine at the fenceline.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of over 100 different chemicals that are known to be formed during incomplete combustion of organic matter at high temperature. Examples of incomplete combustion include fossil fuel burning, combustion in motor vehicle engines, waste incineration, oil refining, and coke and asphalt production. Due to their carcinogenic/mutagenic effects, 16 PAHs are currently listed as priority air pollutants. Typical analytical methods used to monitor PAHs require multistep sampling preparations and are not suited for continuous monitoring. There are studies for developing continuous monitoring of PAHs⁴ [3]. However, at the time of this writing, staff is not aware of any real-time technology for fenceline monitoring.

Metals: Cadmium, Manganese, and Nickel

Cadmium, manganese, and nickel are identified in the OEHHA 2019 report as candidates for air monitoring. Their toxicity-weighted emissions scores are among the highest of emissions from refineries. Exposure and bioaccumulation of metals have been shown to lead to numerous health problems. Those metals are associated with many refinery process units. For example, manganese emissions could be associated with boilers, cooling towers, crude units, heaters,

~~[3] M. R. a. D. B. Franck Amiet, "Continuous Monitoring of Polycyclic Aromatic Hydrocarbons Using Automatic Thermal Desorption Gas Chromatography," 2016.~~

storage tanks, cokers, Fluid Catalytic Cracking Units (FCCUs), incinerators, etc. However, the FCCU is the only source that could have a large-scale release of metals as part of spent catalyst. The Electrostatic Precipitator (ESP) is a control equipment to remove PM from the FCCU flue gas. There were incidents of refinery ESP failure or explosion that resulted with large amount of spent FCCU catalyst with high PM and metal emissions being released to the nearby community. A speciated metals analyzer is commonly utilized for real-time monitoring of multiple metals in air samples, including cadmium, manganese, and nickel.

Hydrogen Sulfide (H₂S)

Hydrogen sulfide is a colorless, flammable, extremely hazardous gas with a “rotten egg” smell. It can result from the breakdown of organic matter in the absence of oxygen such as in swamps and sewers. It can also; occurs naturally in crude petroleum and natural gas, and is produced at oil refineries as a by-product of refining crude oil. -As a result, low-level concentrations can occur continuously at ~~petroleum~~ refineries and its measurement will help identify potential leaks at refineries and address community odor concerns.

Carbonyl Sulfide (COS)

Carbonyl sulfide (COS) is naturally found in crude oil and is a chemical intermediate and a byproduct of oil refining with a distinct sulfide odor. It is classified as a California Toxic Air Contaminant (TAC) and a federal hazardous air pollutant (HAP). COS can be released into atmosphere as fugitive emissions from refineries and at high concentration levels may cause narcotic effects in humans. COS can be measured using open-path technologies and ~~should~~shall be measured and reported at the fenceline. ~~if the selected open path monitors can detect it at desirable levels.~~

Ammonia (NH₃)

While the main sources of ammonia are natural, primarily from the decay of organic matter, ~~petroleum~~ refineries can also emit considerable amounts, particularly from catalyst regenerator vent releases. It is colorless, pungent-smelling, and corrosive and even though it is unlikely to have adverse effect on health at background levels, exposure to high concentrations following an accidental release or in occupational settings may induce adverse health impacts.

Black Carbon (BC)

Black carbon (BC) is a product of incomplete combustion of fossil fuels, biofuels, and biomass, and it is emitted directly into atmosphere in form of particles, mostly in the PM_{2.5} ~~PM_{2.5}~~ size range. BC is a major component of “soot”, a complex mixture that also contains some organic carbon (OC). It is emitted in high quantities by diesel engines and biomass burning. Although BC is often associated with emissions from heavy-duty diesel engines, a portion of all combustion emissions contains ~~these constituents~~BC. BC has been routinely used to estimate the contribution of diesel particulate matter (DPM) to total PM. DPM is the major contributor to air toxic health risk in the South Coast Air Basin; ~~however,~~ it cannot be directly measured through atmospheric measurements and has to be estimated, usually based on BC measurements. In order to help determine if refineries add significant BC concentrations to nearby urban

environments and discern the contribution of refineries to observed BC levels in the community, ~~the refinery operator/owner or operator~~s are advised to determine potential BC hotspots on the facility fenceline (or within the facility); and perform BC measurements.

Hydrogen Cyanide (HCN)

Hydrogen cyanide is colorless, highly flammable and can be explosive when exposed to air in high concentrations. It is released from various industrial activities, including refining. At high concentrations, such as from accidental releases, it is highly toxic. HCN can be effectively measured using open-path technologies and should be measured and reported at the fenceline ~~if the selected open-path monitors can detect it at desirable levels.~~

Hydrogen Fluoride (HF)

Hydrogen fluoride (HF) is a pungent, highly corrosive acid used at some oil refineries in a process called alkylation that boosts gasoline octane. HF also is used at chemical plants to manufacture compounds including refrigerants. The chemical poses a health risk to nearby residents and businesses because in the event of an accidental release, it can form a dense, fuming cloud capable of etching glass and causing severe damage to human skin and lung tissue. ~~The facilities with alkylation units may already have monitors in place for detecting HF, such as could be associated with an accidental releases. Such monitors should ideally be placed near the alkylation unit, to ensure a rapid detection of accidental leaks to subsequently provide warning and real-time alerts to inform health concerns for the protection of refinery workers and the nearby communities in the vicinity of the refinery. All facilities that use hydrogen fluoride must monitor the ambient concentrations of HF or demonstrate in the air monitoring plan that HF concentrations are adequately monitored and reported at the alkylation unit to be exempt from HF measurements at the fenceline.~~

Sulfuric Acid

Sulfuric acid is a colorless, oily liquid that exists in air, water vapor, and particulates. It is corrosive to metals and organic materials and emits toxic sulfur trioxide-containing fumes or vapors when heated. In refineries, sulfuric acid is used as a catalyst during alkylation and in various treatment processes. Sulfuric acid has a very high boiling point, around 356°C; therefore, it is not very volatile. If sulfuric acid is released into the atmosphere, it would quickly fall to the ground as a liquid. Due to the nature of the compound, it would not remain in the vapor state long enough to be transported to the fenceline. For this reason, refineries will not be required to measure sulfuric acid at the fenceline.

~~b.~~

c. Criteria for Exclusion

In certain cases, the facility owner or operator can request to exclude a compound identified in Table 1. One example, a facility that does not use Hydrogen Fluoride in their operations could propose to exclude it in their FAMP. Another example is the case of PAHs, as described above, at the time of writing this Guidance Document, staff is not aware of any real-time technology for fenceline monitoring PAHs. That would serve as technical justification to not include real-time

monitoring for PAHs in the FAMP. In the case of cadmium, manganese, and nickel as described above, those metals are associated with many refinery process units; however, a FCCU is the only unit capable of emitting high concentrations of metals as part of spent catalyst. A facility without a FCCU or any other source of metal emission from routine or non-routine operation, that can demonstrate their metal emission are low, could request to exclude metal monitoring in their FAMP. Also, in the case of a terminal where the operation only includes storage tanks and no sources of combustion, facility owner or operator may propose to exclude monitoring for specific compounds that would not be emitted from their operation.

c.d. Continuous and Real-Time Measurement of Air Pollutants

Continuous air monitoring at or near the property boundaries of ~~petroleum~~ refineries can significantly improve rapid detection and communication of potential hazardous releases to refinery ~~operator~~owner or operators, responders, and the public in addition to providing long-term data, which would be used to determine trends in emissions (e.g., diurnal, seasonal routine emissions variations). Therefore, the fenceline monitoring equipment shall be operated continuously with a ~~required time resolution of~~ five-minute averaging when feasible. High time resolution monitoring reduces the chance of pollutant hot spots being undetected over the measured area and can provide real-time emissions information to refinery personnel and the nearby communities. If achieving the desired time-resolution is not feasible, refinery ~~operator~~owner or operators shall provide rationale in the ~~air monitoring plan~~ FAMP for any proposed averaging~~time resolutions~~ greater than five-minutes ~~averaging~~ (e.g., based on the equipment employed, the number of paths covered by each open-path system, or other operational limitations).

d.e. Selection of Fenceline Air Monitoring Technologies

A ~~petroleum~~ refinery fenceline air monitoring system is a combination of equipment that measures and records air pollutant concentrations at or near the property boundary of a ~~petroleum~~ refinery. Multiple technologies may need to be employed to ensure adequate compound identification and fenceline spatial coverage. Conventional fenceline air monitoring techniques rely on point monitors that only provide concentration information from a single point in the survey area, greatly increasing the chances of missing surface emissions hotspots or emissions plumes. ~~Therefore, e~~Even after collecting data from multiple points in the survey area, ~~the~~ point sampling approaches may lack the spatial or temporal data necessary to obtain a complete picture of the emissions from large area sources. As a result, adequate number and spatial distribution of point monitors must be considered for fenceline air monitoring.

Open-path technology is a well-established method to measure path-integrated trace gas absorptions and concentrations in the open atmosphere making it ideal for long-term fenceline monitoring of pollutant concentration levels emitted from refineries or other large area sources. Open-path technology is a type of Optical Remote Sensing (ORS) that measures air pollutant concentration levels along an open path, significantly improving the spatial coverage. ORS instruments use a light signal to continuously detect and measure concentrations of several

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chemical compounds simultaneously along the distance covered by the light signal in real-time. As a result, open-path technologies can provide greater temporal and spatial resolution compared to conventional air monitoring techniques; ~~for example e.g.~~, narrow pollutant plumes can be detected by an open-path fenceline air monitoring system that might otherwise be missed by point monitors. The light source emits light towards a detector, either at the opposite end of the light path (bi-static configuration) or co-located with the light source (mono-static configuration) if the light is reflected back by a reflector, providing path-averaged concentrations of multiple pollutants, simultaneously. Although the open-path ORS techniques have been used for over 20 years and are well-established, they are constantly improving and gaining use for large area source monitoring applications that are not ~~conductive~~ conductive to traditional point source testing methods. Improvements often include changes to technologies that improve detection limits, or the type of compounds detected.

Path-averaged monitoring approach presents a Another advantage of open-path measurements ~~is the capability~~ of monitoring ~~pollutant concentrations due to point source and~~ fugitive emissions at or near the property boundary of a ~~petroleum~~ refinery operation. Fugitive emissions are emissions of gases or vapors from leaks and other unintended or accidental releases of ~~emissions~~ pollutants. Leaks from pressurized process equipment generally occur through valves, pipe connections, mechanical seals, or related equipment, usually originating from the process area and storage tanks. ~~Fugitive emissions also occur from storage tanks.~~ These tanks are used to store crude oil prior to refining, intermediates between refining processes, and refined product streams. Except for a few process storage tanks, the storage tanks are generally located together in what is referred to as the “tank farm.” Due to the large number of potential leak sources that are scattered over a wide area at large refineries, and difficulties in detecting and repairing these leaks (which may become significant collectively), these emissions are best monitored over a large area or path, using ~~the open-~~ path systems. U.S. EPA has published a comprehensive assessment of various open-path ORS technologies, outlining the advantages and limitations of each measurement method.⁵ In addition, South Coast AQMD conducted a comprehensive ORS technology demonstrations study to assess open-path capabilities for fenceline air monitoring⁶ [4]. Based on the advantages that open-path technologies provide over conventional air monitoring techniques, South Coast AQMD staff recommends the use of open-path technology, when applicable available, and appropriate for implementing a fenceline air monitoring system required by Rules 1180 and 1180.1.

The ~~air monitoring plan~~ FAMP must provide specifications for the fenceline instruments selected for a fenceline air monitoring system, such as detection limits of the equipment for each chemical and time-resolution capabilities. Prior to the installation of open path systems, expected detection limits for open-path instrumentation (described by different manufacturers as Method

⁵ <https://www3.epa.gov/ttnemc01/guid/nd/gd-052.pdf>
⁶

[4] South Coast Air Quality Management District, "Optical Remote Sensing Studies," 2015. [Online]. Available: <http://www.aqmd.gov/ors-study>.

Detection Limits (MDLs) or Method Quantification Limits (MQLs) for Rule 1180 compounds should be listed in facility's FAMP. These predicted MDLs are mainly the result of theoretical estimates based on spectroscopic specifications of the fenceline air monitoring equipment and estimated light path length. In real-life, actual MDLs of an open path system are dynamic quantities that are also depended on atmospheric conditions (e.g., MDL will increase as atmospheric visibility decreases), the presence of interfering or unknown compounds, the unique characteristics of each spectroscopic system, the atmospheric path length, and equipment performance. Real-life MDLs can be higher or lower than projected and can also change with time. Therefore, it is necessary to periodically re-evaluate and update open path MDLs for all measured compounds. Ideally, MDLs should be calculated for each open-path measurement. For open-path analyzers that do not provide this capability, MDL re-evaluation should be conducted for each Rule 1180 compound for each open path system every two weeks (at a minimum) or more frequently. Also, the ~~air monitoring plan~~ FAMP must demonstrate that the instruments can adequately measure the pollutants identified in Table 1. The selected open-path instruments should be able to record and store the measured spectral-, background and reference spectra and any other data used for concentration retrievals, ~~absorption~~ and associated average concentrations of measured pollutants for retrospective investigations. ~~Where open-path monitors are being operated,~~ All factors that could affect air pollutant measurements where open-path monitors are being operated, such as the maximum path length the instruments are capable of measuring and potential interferences, must be discussed in the ~~air monitoring plan~~ FAMP. In certain instances, a ~~refinery facility~~ owner or operator may demonstrate that other air monitoring techniques and/or technologies (e.g., emerging technologies) could be used in place of open-path technology ~~depending on the~~ for certain pollutant(s) that are monitored.

e.f. Alternative Fenceline Air Monitoring Technologies

In certain instances, alternative monitoring technologies may be appropriate to cover areas along the perimeter of a refinery (for example, along the portions of the fenceline where open-path monitoring is not feasible, or for pollutants that cannot be reliably measured by open-path technologies). In these instances, the refinery ~~operator~~ owner or operator may propose an alternative air monitoring technology(s). ~~The refinery operator~~ owner or operator must demonstrate the proposed alternative air monitoring technology(s) will meet the requirements of Rules 1180 and 1180.1 and provide adequate sensitivity and adequate temporal and spatial coverage for the compounds identified in Table 1.

f.g. Fenceline Sampling Location(s) and Coverage

~~Air monitoring plans~~ The FAMP must achieve the complete fenceline special coverage, whenever feasible, and provide ~~specify~~ the following information related to the locations selected for the fenceline air monitoring equipment:

- Areas along the perimeter that are likely to detect compounds associated with ~~petroleum~~ refinery operations;
- Locations of refinery equipment or operations that may be emitting these compounds;

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- Proximity of proposed fenceline monitoring equipment to residences in the community and other sensitive receptors, such as schools, day~~ta~~ care centers, hospitals, clinics, nursing homes, and recreation areas;
- Where equipment will be sited (e.g., GIS coordinates);
- Elevations at which equipment will be placed; and
- Length of each path that will be monitored with fenceline instruments.

The ~~air monitoring plan~~ FAMP must provide ~~provide a discussion that explains~~ the rationale for ~~choosing these~~ the siting of the refinery fenceline monitoring equipment ~~equipment siting specifications~~. ~~When considering a suitable fenceline technology for sites along the refinery perimeter,~~ the refinery facility owner or operator must address key considerations when siting, such as, the distance necessary to accurately measure emissions and critical transport areas around the perimeter of the ~~petroleum~~ refinery. These considerations are further discussed below.

To ensure the highest level of accuracy when measuring emissions levels at or near the property boundary of a ~~petroleum~~ refinery facility the fenceline air monitoring system ~~should~~shall be designed considering the following key factors:

Local Meteorological Conditions

Meteorological conditions can significantly affect the concentration of air pollutants in a region; ~~It~~ therefore, it is important that the ~~petroleum~~ refinery ~~operator~~ owner or operator consider the typical meteorological conditions (e.g., wind patterns, temperature, rainfall, cloud cover, etc.) of a site. ~~For~~ example, if a facility is in an area that is prone to fog, the facility ~~operator~~ owner or operator should ensure the equipment for the fenceline air monitoring system is not sensitive or easily impeded by low-lying cloud cover ~~produced by fog~~.

Evaluating historical meteorological data is imperative in air monitoring equipment site selection and in determining whether certain candidate equipment locations are likely to experience higher measured pollutant concentrations from an emissions source. ~~Wind~~ can be the most critical meteorological element for the transport of refinery emissions to the surrounding communities. ~~Often~~, peak concentrations occur during stable, low wind speed conditions when pollutants can build up and drift meander in any direction. To the extent feasible, both long- and short-term wind measurements ~~should~~shall be assessed in the ~~air monitoring plan~~ FAMP. Frequency distributions of winds and associated graphic analyses (i.e., wind roses) can be analyzed to evaluate predominant wind patterns, as well as diurnal and seasonal variability.

Topography

Concentrations of pollutants can be greater in valleys than for areas of higher ground. ~~This is~~ because, ~~under certain weather conditions,~~ pollutants can become trapped in low lying areas under certain weather conditions. Therefore, the topography of the refinery can affect the distribution and dispersion of pollutants from refinery operations. ~~The petroleum refinery operator should design the~~ fenceline air monitoring system ~~to ensure fenceline air monitoring~~

~~equipment is sited such that it captures at~~ the most critical transport and dispersion areas along the perimeter of the facility -would show more emissions to the extent feasible.

Pollutant Hotspots

It is essential for the refinery ~~operator~~owner or operators to identify potential pollutant hotspots within the facility to ensure fenceline monitoring of these emissions and to provide effective information to the neighboring communities with sufficient spatial coverage. ~~Therefore, in~~ developing the ~~air monitoring plan~~FAMP, the refinery ~~operator~~owner or operator should survey the facility with special attention to areas where emissions are most likely, such as, tank storage, processing, wastewater treatment, and loading areas. ~~Information gathered from the survey should be used to establish the facility's overall emissions profile. The survey should also consider geographical and topographical parameters, as well as the elevation of potential pollutant hotspots.~~

Spatial Coverage of Monitors

The fenceline monitoring system ~~should~~shall be designed to ensure adequate coverage of the area along the facility perimeter, to the extent feasible. Considerations, such as, the proximity of refinery emissions sources to sensitive receptors (i.e., residents, schools, hospitals, etc.) and type of pollutants to be measured could require additional open-path monitors for a facility. In addition, an existing fenceline monitoring system installed and maintained by another Rule 1180 or 1180.1 facility along a shared fenceline may be considered when evaluating adequate coverage. If facility chooses to include fenceline air monitoring data from another facility along the shared fenceline, both refineries must integrate such data into their data display and notification systems and include relevant information in their FAMPs and QAPPs. Also, ~~information available from dispersion modeling, gradient sampling, and mobile measurements, should also be taken into consideration~~ when assessing adequate coverage of a facility perimeter with a fenceline air monitoring system.

For metal monitors, since the only source of significant metal emissions are FCCU and ESP, the facility owner or operators could propose in their FAMP, with sufficient technical justification, that adequate coverage may be achieved with a limited number of air monitors located near those units.

Sampling locations should be away from certain ~~supporting~~ structures and have an open, unobstructed path. Ideally, each air monitoring path should have an unobstructed line of sight be at least 1 meter vertically and horizontally from any supporting structure, and be away from dusty or dirty areas, whenever possible. Additionally, locations and heights of monitoring paths should be selected to maximize the potential of capturing unwanted emissions, which may require positioning of analyzer shelters and/or reflectors at elevations of 15 feet or higher, depending on facility layout. ~~Moreover, the air monitoring plan~~FAMPs must identify potential disruption of airflow and the potential effect on measured concentrations caused by obstacles or traffic. Also, potential interferences caused by meteorological (e.g., fog or rain) or process issues (e.g., process steam) associated with the selected location(s) must be addressed. The air

monitoring plan ~~should~~shall describe how the proposed fenceline air monitoring system will effectively provide relevant information for all nearby communities, especially downwind communities, given the expected meteorological conditions.- Due to the high prevalence of marine fog in the areas where the ~~Basin~~South Coast AQMD refineries are located, heaters and fans may be required to keep the instrument optics and reflector mirrors free of moisture to maximize data recovery.

g.h. Emerging Technologies

Some emerging next-generation monitoring technologies ~~could possibly~~might meet the requirements for ~~this rule~~Rules 1180 or 1180.1. For example, it is possible that PM2.5 low-cost sensors could ~~potentially~~one day allow cost-effective, real-time monitoring at numerous fixed locations along the perimeter (i.e., the fenceline) of a ~~petroleum~~-refinery.- Despite substantial progress, at this time, none of these methods can provide the level of sensitivity and accuracy ~~required~~necessary to measure the pollutants required ~~by~~in Table 1 at the levels expected during normal refinery operations. However, gaseous sensors ~~are expected to~~may improve in the ~~near~~ future, at which point ~~and fenceline air monitoring plans the FAMPs could~~would be ~~augmented~~ revised to include the potential use ~~employ of~~ these sensors. ~~;~~ therefore, ~~South Coast AQMD may would~~ consider approving emerging technologies in the future. ~~for future compliance with Rules 1180.~~

~~SCAQMD has established an Air Quality Sensor Performance Evaluation Center (AQ-SPEC)⁷ to inform the public about commercially available low-cost sensors. Under this program, the performance of these sensors is compared against Federal Reference Method (FRM), Federal Equivalent Method (FEM), and Best Available Technology (BAT) instruments to determine their performance relative to more established measurement techniques. Some of these commercially available low-cost sensors can provide measurements for criteria pollutants (e.g., ₅PM2.5, PM₁₀, ozone, NO₂, and CO) which correlate well with FRM, FEM, and BAT methods, however, the situation is different for gaseous air toxics, where sensors with sufficiently low detection limits for specific compounds (e.g., benzene) are generally not available at this time. Total VOC concentrations can be measured using sensors based on Photon Ionization Detection (PID) at parts per billion (ppb) levels, although they do not provide VOC speciation and are not considered “low cost” sensors. These sensors can serve as a temporary measurement technique in the event of an equipment failure or during extended maintenance activities until the fenceline air monitoring system is restored to normal operating conditions. However, as a substitute for the ORS-based approach, the refinery operators would have to deploy a network of traditional point monitors simultaneously at the fenceline of a facility. This would likely result in substantially increased sampling and analysis costs in order to achieve same level of temporal and spatial resolution and speciation of the target pollutants achieved with the ORS methods. In comparing the costs of an ORS based measurement approach with traditional point monitoring~~

⁷<http://www.aqmd.gov/aq-spec>

~~approaches for long-term fenceline measurements, an ORS-based approach is likely to be more cost-effective.~~

4. Meteorological Measurements

Exposures to air contaminants within an urban area can vary greatly due to proximity to emission sources; the magnitude and specific mix of emissions; structures and terrain influences; and meteorological conditions. Variability in wind speed and direction ~~in particular,~~ pose significant challenges for the analysis of data from air quality monitoring programs and exposure assessments ~~that rely on the ability to determine upwind and downwind locations in relation to emissions sources at any time. Therefore, a~~ An understanding and assessment of the general meteorological patterns in and around each facility is a critical component in ~~not only~~ the design of the measurement systems ~~but and when~~ also interpreting the measurement results, including the transport and dispersion of air pollutants from the refinery to the community. [Open-path measurements can also be affected by atmospheric visibility.](#) ~~Therefore, visibility monitors should also be included in fenceline air monitoring installations.~~ ~~Therefore, the sub-paragraph (d)(2)(D) of Rule 1180 requires fenceline monitoring locations to continuously record wind speed and wind direction data.~~

The ~~Air Monitoring Plan~~ FAMP must provide information on siting considerations and equipment to be employed for real-time meteorological data collection at high time resolution (at minimum, matching the time resolution of the air quality monitors), in order to provide high quality data. Wind sensor quality, siting, and quality assurance shall meet the specifications and guidelines that are typically required by air quality regulatory measurements and modeling purposes (for reference, see the U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements [5]⁸).

5. Quality Assurance/Quality Control (QA/QC)

~~Refineries must ensure that the data is high quality. The measurements from the fenceline air monitoring system shall reflect a commitment to quality data that is outlined in the air monitoring plan.~~ The ~~air monitoring plan~~ FAMP shall address:

- ~~Quality assurance, including training of personnel; development and maintenance of proper documentation [i.e., instrument manuals, Standard Operating Procedures (SOP), and a Quality Assurance Project Plan (QAPP)];~~
- ~~Routine maintenance and calibration checks;~~
- ~~Technical audits;~~
- ~~Data verification and validation; and~~
- ~~data quality assessment.~~

⁸ ~~https://www3.epa.gov/ttn/amtic/files/ambient/met/Volume_IV_Meteorological_Measurements.pdf~~

[5] U.S. EPA, "Quality Assurance Handbook for Air Pollution Measurement Systems," 2008. [Online]. Available: https://www.epa.gov/sites/default/files/2021-04/documents/volume_iv_meteorological_measurements.pdf.

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A QAPP for each refinery fenceline monitoring project must ~~be developed that~~ outlines the QA/QC plan, following U.S. EPA guidelines [6]⁹. The QAPP provides a blueprint for conducting and documenting a study or program that produces quality results and must outline the specific goals of the monitoring networks and instrumentation, the data quality that is required and how that relates to when data generated by the instrumentation is accepted, and how the data will be reviewed and managed by the refineries. The QAPP ~~should~~ shall provide clear definitions and procedures for QA/QC ~~that are~~ necessary to indicate why some data may be missing, suspect, or invalid.

The critical functions to be addressed in the QAPP based on the U.S. EPA guidelines are summarized below:

- **Project ~~B~~background and ~~M~~management:** The QAPP ~~should~~ shall provide background information and ~~define the problem(s) to be addressed and~~ the general goals of the fenceline ~~and community~~ monitoring system, ~~and describe~~ including:
 - ~~P~~Project organization including all personnel working on the project;
 - ~~Q~~Quality objectives and acceptance criteria for measurement data;i and
 - Plans for documentation, record keeping, and data dissemination.
- **Technical Approach:** The QAPP ~~shall~~ should demonstrate that the appropriate approaches and methodologies are employed for performing data measurements, and data handling, ~~and quality control are selected and address the design and implementation of the measurement systems.~~
- **Assessment/Oversight:** The QAPP ~~should offer~~ shall provide appropriate QA/QC steps for ensuring the effectiveness of the monitoring plan. It shall cover ~~covering~~ experimental design,i representativeness of the data;i instrument operation and data acquisition;i calibration check procedures, data quality indicators, independent systems and performance audits;i and peer ~~-~~review.
- **Data Validation and Usability:** The QAPP ~~shall~~ should describe what steps shall ~~will~~ be taken to ensure that the individual data elements conform to the criteria specified in the monitoring plans.

All monitoring data must be collected, managed,i and archived in a standard electronic format after necessary data processing and validation. Processing the data involves collecting the data, assuring its quality, storing the data in a standardized format, and interpreting the data for communication to the public. The most critical steps in this process include:

- Automatically retrieving data from the fenceline monitors containing the measured levels of each air pollutant along with meteorological parameters;

⁹ U.S. EPA (2002). ~~Guidance for Quality Assurance Project Plans. EPA/240/R-02/009.~~
~~[https://www.epa.gov/sites/production/files/2015-06/documents/g5-final.pdf]~~

[6] U.S. EPA, "Guidance for Quality Assurance Project Plans," December 2002. [Online]. Available: <https://www.epa.gov/sites/default/files/2015-06/documents/g5-final.pdf>.

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- Validating data file completeness and integrity;
- Transferring file contents to a database;
- Flagging data that do not meet pre-defined quality control limits;
- Copying quality assured data and indices into a database for use by data display and dissemination program;
- Generating and recording logs to monitor system operation;
- Notifying the public ~~ications~~ when measured concentrations are above ~~pre-defined concentrations limits~~ the notification thresholds.

To ensure that the collected data meets the highest quality possible, each piece of monitoring equipment must be operated in strict accordance with an in-depth operating protocol. To achieve the appropriate level of detail and standardization, and to consequently ensure that the monitoring equipment provides high quality data, Standard Operating Procedures (SOPs) must be prepared for each specific measurement method. The SOPs ~~should~~ shall be informed by general operating instructions that are typically provided by the manufacturers of equipment, by operational experience and audits, and by general operational guidelines and performance specifications that are available for U.S. EPA and State approved methods. The SOPs ~~should~~ shall address ~~specific topics, such as~~ calibration procedures and quality control procedures, including (indicating standards and checks, acceptance criteria and schedule); ~~as well as~~ and data reduction procedures including (indicating validation procedures, reporting and schedule).

Rules 1180 and 1180.1 ~~requires that~~ the measurements from the fenceline monitoring system be available to the public on a real-time basis with ~~Quality Assurance/Quality Control (QA/QC)~~ measures implemented to provide confidence in the data ~~collected~~. Publicly available quarterly measurement reports ~~should~~ shall reflect a higher level of data validation, including a manual review of the data by qualified personnel. The real-time and near-real-time disseminated measurement data should not be considered final, but it is important that the preliminary real-time measurement data distributed to the public be of an acceptable quality. ~~Also, it is important that instrument~~ downtime ~~failures~~ are detected quickly, with automated screening where feasible, to prevent grossly invalid data from being presented to the public. This can be accomplished by utilizing built-in status flags on the instrument operational parameters and by providing real-time data screening for outliers, impossible values, stuck values, negative values, rates of change, excessive short-term noise, etc. In addition to selected compounds required by Rule 1180, open-path analyzers are also capable to accurately detect and quantify common atmospheric constituents such as Ozone (for UV-DOAS open-path analyzers) and nitric oxide and carbon dioxide (for FTIR open-path analyzers). At a minimum, facilities therefor must report these measurements in quarterly data summaries report, as a part of data QA/QC.

6. Independent Audit

South Coast AQMD staff has been working with each facility to assure appropriate instrumentation, standardization of data acquisition and reporting, and appropriate procedure implementation to produce high-quality data. However, there is a need to have an independent

party conduct a systematic review of the entire fenceline air monitoring network and ensure that the collected refinery data meets the stringent quality assurance criteria of QAPP.

Based on the results of a Request for Proposals (RFP), South Coast AQMD selected a qualified contractor to develop an auditing protocol and implement the first independent audit of all fenceline air monitoring systems subject to Rule 1180. Staff anticipates the audit methodology will be developed by the second quarter of 2024, followed by audits initiated by July 1, 2024. The audit protocol, or some portions of the protocol, developed through this process will also be used as the basis for conducting independent audit for facilities subject to Rule 1180.1.

Rules 1180 and 1180.1 require an initial independent audit and reoccurring audits to ensure the systems provide accurate data. The independent audit shall be performed by a qualified independent party according to the independent audit protocol to identify any deficiencies in the fenceline air monitoring system and quality assurance procedures. The refineries audited by the contractor selected by South Coast AQMD based on the results of the RFP# P2022-13, can consider this audit as the initial independent audit.

The audit reports shall be finalized with a signature by the qualified independent party, submitted to the South Coast AQMD, and made available to the public via the web-based fenceline notification system by the refinery within 90 days after the audit has been performed.- The signature serves to certifying under penalty of law, based on information and belief formed after reasonable inquiry, that the statements and information in audit report and in all attachments and other materials are true, accurate, and complete.

6.7. Data Display and Dissemination

The primary goal of Rules 1180 and 1180.1 is to collect real-time emissions data and share that data with the community, local responders, and industry, to the extent feasible and as quickly as possible, so that ~~it can be~~they can use the data ~~used~~ to evaluate and adaptively manage the impacts of refineries' emissions on the community. ~~Therefore, it~~ is essential that the collected data ~~must be~~is made available and displayed online in a relevant, useful and understandable manner to the public in real-time or near-real-time and clearly identified as preliminary data. To provide context to this complex data set for the public, the designed website shall contain information regarding the species measured and the measurement techniques, a discussion of levels of concern for each measured species, typical background levels, potential non-refinery sources that could contribute to measured concentrations, and definitions of data QC flags. This should be written with clarity and thoroughness and with links provided to additional sources of information. In addition, the FAMP and the data website should include details of how the public can report experiences and provide comments and feedback for improvement of the website and other data dissemination tools, and the monitoring activities in general.

The facility owner or operator must maintain a web-based data display to display, store, and make-, at a minimum, the following information publicly available.

a. Real-Time or Near-Real-Time Data

The real-time or near-real-time data must be made publicly available on the facility's fenceline monitoring data display webpage ~~submitted to SCAQMD~~, in a real-time or near-real-time

~~as quickly as practicable~~, in an approved format. The refinery ~~operator~~owner or operators must also publish quarterly reports, root cause analysis, and other information specified by Rules 1180 and 1180.1 subdivision (g) ~~written at a public friendly level~~ on the data dissemination website. The ~~air monitoring plan~~ FAMP must include information and examples of how the quality-controlled data will be displayed and the steps taken to provide context to the real-time measurements to the public. Also, the ~~air monitoring plan~~ FAMP shall address means for providing automated, reliable, useful, and understandable information, including, the intent and limitations of the data collected and an explanation of how background concentrations and/or contributions from other sources may affect measured concentrations.

b. Historical Data

The facility owner or operators must make historical data publicly available on facility's fenceline monitoring data display webpage, including a graphical data display, with the ability to download electronic data that includes all historical measurements from each monitor for all air pollutants measured as one-hour averages, including time, date, and windspeed data. The data must be made available to the public in a timely and accessible manner that is easy to find on the website and can be understood by the general public. In addition, the facility owner or operators must make electronic real-time and historical data available to the Executive Officer in an approved format.

bc. Quarterly Report

The ~~refinery-facility operator~~owner or operators must ~~provide~~ make quarterly data reports publicly available on facility's fenceline monitoring data display webpage. The quarterly report should include:

- ~~• after rigorous review of e~~Calibration data; ~~data processing calculations (such as conversion calculations of instrument signal to pollutant concentration);~~
- ~~• d~~Data consistency;
- ~~• f~~Field data sheets and logbooks;
- ~~• i~~Instrument performance checks; ~~and~~
- ~~• e~~Equipment maintenance documentation; and
- ~~• e~~Calibration forms.

The quarterly report shall at a minimum include all information specified in Rules 1180 and 1180.1 paragraph (j)(3) and in a standardized format approved by the Executive Officer. All changes to the ~~recorded~~reported real-time data must be explained in quarterly reports.

~~The major goals of the outreach program include:~~

~~Developing multiple communication venues to ensure widespread access to environmental information and to appeal to the various communication preferences (e.g., text messages, email, website, etc.) among the end users;~~

~~Promoting access to and awareness of the measurements and use of the real-time air pollution data through an active outreach and education program;~~

~~Developing contextual material to assist interpretation and understanding of the real-time data and its limitations;~~

~~Designing an effective public outreach program (e.g., informational meetings, workshops, etc.) that informs the public about the health impacts associated with emissions levels detected by the fenceline air monitoring system and informs decision related to reducing community exposure;~~

~~Identifying designated personnel to address SCAQMD's and public questions about monitoring equipment and readings.~~

ed. Root Cause Analysis

When an air pollutant exceeds the notification threshold, Rules 1180 and 1180.1 require the facility owner or operator to conduct a root cause analysis. The root cause analysis is the process of discovering the root cause of the emissions exceeding the thresholds. The rules provides specifications on the analysis, which primarily include:

- Timeline for:
 - Initiating the analysis;
 - Conducting corrective action, if applicable, and
 - Making the root cause analysis report available on the online platform;
- Key elements to include in the analysis; and
- Corrective action.

The root cause analysis report and corrective action(s), if required, must be submitted to the Executive Officer and posted on the facility's fenceline monitoring data display webpage within the timeline specified in Rules 1180 and 1180.1.

The air monitoring data must be provided in a manner that the public can readily access and understand. Websites for all refineries ~~should~~shall be designed in a user-friendly format. In order to make the data provided ~~in this outreach~~ as accessible as possible, the project websites should use data visualization tools to graphically depict information using maps and time series plots of measured pollutants and wind data. In order to provide context to this complex data set for the public, the designed website ~~should~~shall contain information regarding the species measured and the measurement techniques, discussion of levels of concern for each measured species, typical background levels, potential non-refinery sources that could contribute to measured concentrations, and definitions of data QC flags. ~~This should be written at a public friendly level with clarity and thoroughness and with links provided to additional sources of information. In addition, the air monitoring plan and the data website should include details of how the public can report experiences and provide comments and feedback for improvement of the website and other data dissemination tools, and the monitoring activities in general.~~

7.8. Notification System

The website ~~shall~~should offer an opt-in notification system that is integrated with the data collected by the air monitoring network. ~~that~~ The notification system shall automatically

generates and issues notifications to subscribers when the concentration of any~~each of the~~ pollutant ~~levels exceeds~~ the corresponding thresholds pursuant to the approved ~~air monitoring plan~~FAMP.

a. Notification Thresholds

In establishing notification thresholds, ~~Resources that should inform the thresholds include~~ South Coast AQMD reviewed the National Ambient Air Quality Standards (NAAQS), California Ambient Air Quality Standards (CAAQS), and the acute, chronic or carcinogenic Reference Exposure Levels (RELs) ~~as assessed~~ by California Office of Environmental Hazard Assessment [7]~~(OEHHA⁴⁰)~~, which are health standards, and historical fenceline air monitoring data. Except for six pollutants, air pollutants identified in Table 1 of Rules 1180 and 1180.1 have health standards available for establishing a health standard-based threshold. The six air pollutants without health standards are total VOCs, ethylbenzene, black carbon, naphthalene, PAHs, and cadmium. Informational notification thresholds based on fenceline air monitoring data collected since the beginning of Rule 1180 fenceline air monitoring in 2020 have been established for total VOC and black carbon. These notification thresholds were developed to provide information to members of the community who subscribe to receive notifications from refinery fenceline air monitoring systems and will indicate when air pollutant measurements exceed levels typically detected at the fenceline. No informational notification thresholds have been established for ethylbenzene as its historical fenceline air monitoring data were mostly below the air monitoring systems' method detection limit. South Coast AQMD was not able to develop informational based thresholds for naphthalene, PAHs, and cadmium as there is no historical data to base the analysis.

The table below lists the health standard-based or informational-based notification threshold for each required air pollutant. One-hour rolling average data are utilized to determine if the notification thresholds would be exceeded, except that eight-hour rolling averages are used for manganese and 24-hour rolling averages are used for PM2.5 and PM10. South Coast AQMD will revise these thresholds and amend Rules 1180 and 1180.1 if the applicable standards and RELs are updated, or when sufficient historical data become available.

⁴⁰ OEHHA, 2008; <http://www.oehha.ca.gov/air/allrels.html>

[7] OEHHA, "OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary," August 2020. [Online]. Available: <http://www.oehha.ca.gov/air/allrels.html>

Table 2 Air Pollutants and Notification Thresholds

<u>Air Pollutants</u>	<u>Health Standard-Based Notification Threshold (ppb)</u>	<u>Informational-Based Notification Threshold (ppb)</u>
<u>Criteria Air Pollutants</u>		
<u>Sulfur Dioxide</u>	<u>75</u>	<u>N/A</u>
<u>Nitrogen Oxides</u>	<u>100</u>	<u>N/A</u>
<u>Particulate Matter</u>	<u>N/A</u>	<u>35 µg/m³ (PM2.5) and 50 µg/m³ (PM10) (24-hr)</u>
<u>Volatile Organic Compounds</u>		
<u>Total VOCs (Non-Methane Hydrocarbons)</u>	<u>N/A</u>	<u>730</u>
<u>Formaldehyde</u>	<u>44</u>	<u>N/A</u>
<u>Acetaldehyde</u>	<u>260</u>	<u>N/A</u>
<u>Acrolein</u>	<u>1.1</u>	<u>N/A</u>
<u>1,3 Butadiene</u>	<u>297</u>	
<u>Naphthalene</u>	<u>N/A</u>	<u>N/A</u>
<u>Polycyclic aromatic hydrocarbons (PAHs)</u>	<u>N/A</u>	<u>N/A</u>
<u>Styrene</u>	<u>5,000</u>	<u>N/A</u>
<u>Benzene</u>	<u>8</u>	<u>N/A</u>
<u>Toluene</u>	<u>1,300</u>	<u>N/A</u>
<u>Ethylbenzene</u>	<u>N/A</u>	<u>N/A</u>
<u>Xylenes</u>	<u>5,000</u>	<u>N/A</u>
<u>Metals</u>		
<u>Cadmium</u>	<u>N/A</u>	<u>N/A</u>
<u>Manganese</u>	<u>0.17 µg/m³ (8-hr)</u>	<u>N/A</u>
<u>Nickel</u>	<u>0.2 µg/m³</u>	<u>N/A</u>
<u>Other Compounds</u>		
<u>Hydrogen Sulfide</u>	<u>30</u>	<u>N/A</u>
<u>Carbonyl Sulfide</u>	<u>270</u>	<u>N/A</u>
<u>Ammonia</u>	<u>4,507</u>	<u>N/A</u>
<u>Black Carbon</u>	<u>N/A</u>	<u>30µg/m³</u>
<u>Hydrogen Cyanide</u>	<u>309</u>	<u>N/A</u>
<u>Hydrogen Fluoride+</u>	<u>289</u>	<u>N/A</u>

+ If the facility uses hydrogen fluoride.

~~An REL is an airborne concentration level of a chemical at or below which no adverse health effects are anticipated for a specified exposure duration as developed by RELs are based on the most sensitive, relevant, adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety. Therefore, exceeding the REL does not automatically indicate an adverse health impact. The REL is not the threshold where population health effects would first be seen. However, levels of exposure above the REL levels may have an increasing but undefined probability of resulting in an adverse health impact, particularly in sensitive individuals (e.g., the very young, the elderly, pregnant women, and those with acute or chronic illnesses). OEHHA has developed acute RELs for assessing potential non-cancer health impacts for short-term, one-hour peak exposures to air pollutants including facility emissions., therefore For example, if the one-hour average concentration of any of the measured pollutants exceed its corresponding acute REL, notifications should be sent out to the subscribers. By definition, an acute REL is an exposure that is not likely to cause adverse health effects in a human population, including sensitive subgroups, exposed to that concentration for the specified exposure duration on an intermittent basis. Chronic RELs are developed for assessing non-cancer impacts from long-term exposure, at or below which no adverse health impacts are anticipated following long-term exposure. Long-term exposure for these purposes has been defined by U.S. EPA as at least 12 percent% of a lifetime, or about eight years for humans. However, for assessment and reporting programs, such as those required by AB 2588, 1-year emissions assessments are typically used for modeling ambient conditions in nearby communities for long-term exposures. Therefore, chronic RELs must be compared to annual average concentrations of measured toxic pollutants and be reported in the periodic reports once one year of data is available.~~

b. Notification System Design

The notification system ~~should~~ shall be designed to provide information to the public, ~~via email, text message, or other~~ approved communication venues ~~methods, with a mechanism for the public to opt-in or opt-out,~~ Examples of methods for communicating the data to the public include the following:

- Website data displays;
- Mobile application;
- Automated email/fax/text notification system;
- Social media feeds;
- Public data displays in community locations; and
- Automated call-in phone system

~~At a minimum, the notification system~~ it shall notify the public of the following: with, at minimum, the ability to be notified regarding:

- (1) The maximum concentration of the air pollutant detected during the period of an exceedance data availability and release of periodic reports;

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- ~~(2) exceedances of~~ The notification thresholds of the air pollutant established in the approved or partially approved FAMPs; and
- ~~(3) Duration of the exceedance monitoring system status.~~

For each exceedance, an initial notification shall be generated and issued within 15 minutes of the exceedance occurrence and a follow up notification is required within 15 minutes of the conclusion of the exceedance to inform the public the required information. ~~The timely notifications will inform the public when certain pollutants exceed those concentration thresholds or may pose a potential health concern, allowing the public to consider further actions to protect their health.~~ The notifications would also provide information to refinery facility owners or operators so they can ~~to~~ rapidly identify and reduce and mitigate ~~any~~ previously undetected and/or accidental emissions. The notification system shall also send a notification if a fenceline notification was sent in error with an explanation as to the cause of the false fenceline notification. ~~which. This can have a significant impact reduce on the reduction of refinery fugitive emissions.~~

~~Websites should not simply provide graphical information about current conditions. Air monitoring plans should include a plan for how residents can access historical data directly and in a user-friendly manner. The archived data should include data quality control flags, explain changes, and provide information to identify data that should be removed or was removed after QA/QC. The data must also be made available to SCAQMD in an approved format.~~

~~The air monitoring plan should also identify alternative methods of accessing without a computer for those members of the community who may not have internet access (e.g., automated phone systems for dial-in information, or public displays, hard copies of periodic reports in libraries or community centers, etc.). Based on the needs of the communities, providing information in other languages should be strongly considered.~~

~~Some examples of methods for communicating the data to the public include the following:~~

- ~~Website data displays;~~
- ~~Mobile application;~~
- ~~Automated email/fax/text notification system;~~
- ~~Social media feeds;~~
- ~~Public data displays in community locations;~~
- ~~Automated call in phone system;~~
- ~~Television and radio reports; and~~
- ~~Published data summary reports.~~

As provided by state law, emergency response agencies, such as local fire agencies, have the primary responsibility for scene management during an accidental release of emissions or other emergency incidents. The refinery ~~operator~~ owner or operators must identify the primary local agency that provide emergency preparedness and response services for each refinery, and coordinate with the first responders to integrate with and augment the existing public alert

systems and communication mechanisms to provide the public with access to timely alerts and public safety information during refinery upsets and accidental releases of pollutants. The requirements of Rules 1180 and 1180.1 are ~~and~~ not to conflict or duplicate the first response alert systems in case of an accidental release of emissions.

~~The California Air Resources Board (CARB) Monitoring and Laboratory Division and the California Air Pollution Control Officers Association (CAPCOA) have completed the first volume and a draft a second volume of the Refinery Emergency Air Monitoring Assessment Report. The Objective 1: Delineation of Existing Capabilities report, released in May 2015, provides a comprehensive inventory of emergency air monitoring assets and capabilities located in and around California's major oil refineries. The draft report for Objective 2: Evaluation of Air Monitoring Capabilities, Gaps, and Potential Enhancements became available in September 2017. Also in September 2017 OEHHA released a related draft report: Analysis of Refinery Chemical Emissions and Health Effects. These are available from the CARB Refinery Air Monitoring website.¹¹~~

~~8. Other Regulatory Programs~~

~~The U.S. EPA adopted a rule in December 2015 (40 CFR §63.658) with fenceline monitoring provisions that require sampling for benzene at refinery property boundaries. Considering that open-path technologies are currently the best available and the most accurate method for fenceline monitoring of benzene and other pollutants, SCAQMD will assist the refineries in seeking U.S. EPA approval for monitoring systems proposed as part of Rule 1180 through the refinery's fenceline air monitoring plan to also meet U.S. EPA requirements for monitoring of benzene.~~

9. Future Updates to Rules 1180 and 1180 – Refinery Fenceline Air Monitoring Guidelines

Revisions and updates to this guidance are expected ~~and will be required~~ as new instrumentation, methodologies and monitoring strategies are developed. The resolution for the 2023 Rule 1180 amendment and Rule 1180.1 adoption included a commitment to technology assessment. Staff will assess real-time monitoring technologies for any air pollutant listed in Table 1 of the rules by January 1, 2029, and every five years thereafter, and report the results of the assessment to the South Coast AQMD Stationary Source Committee.

¹¹ <https://www.arb.ca.gov/fuels/carefinery/crseam/crseam.htm>

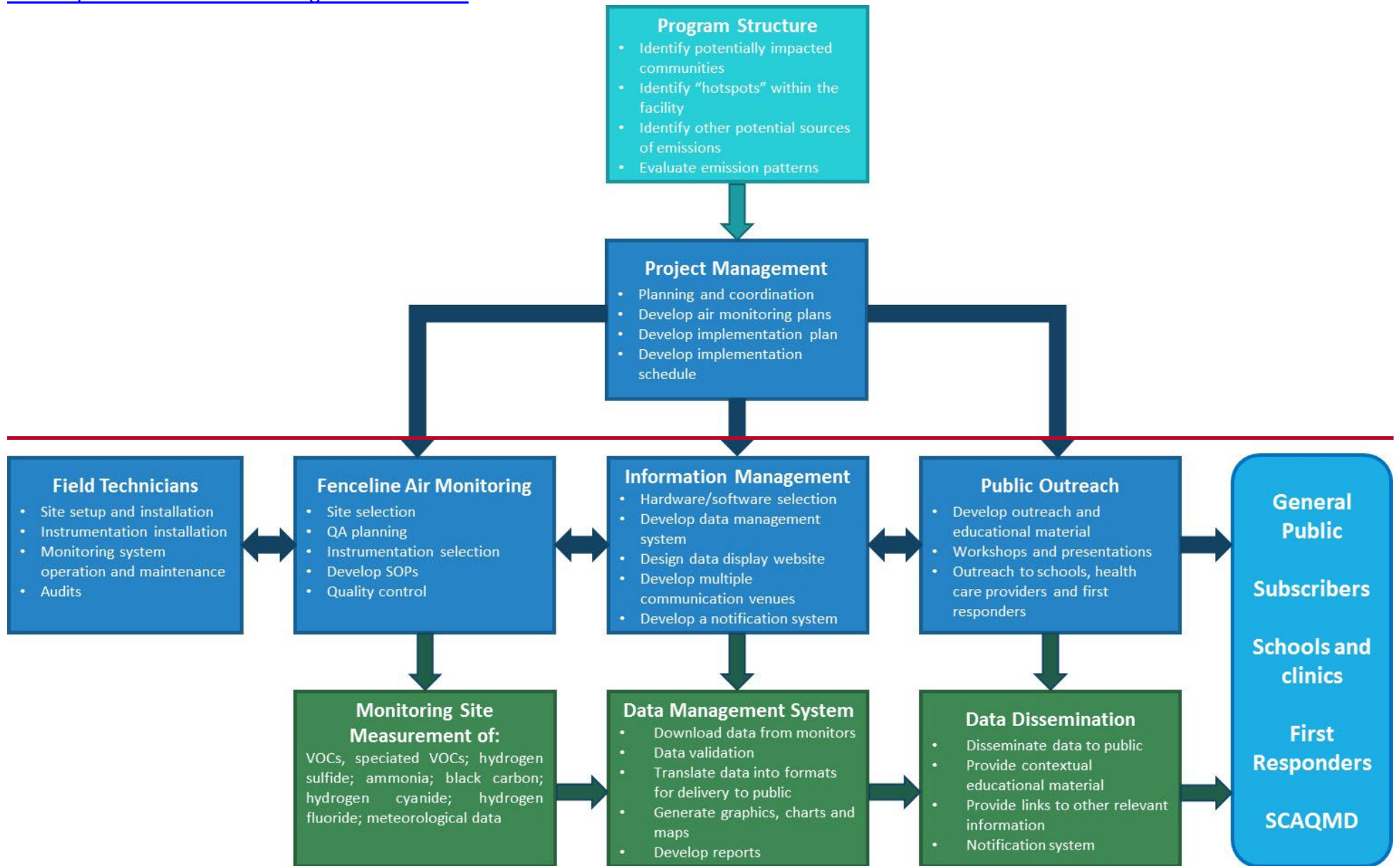


Figure 22—Overview of the Refinery Fenceline Air Monitoring Programs

Appendix A - **FAMP** Checklist

FAMP Checklist	
Fenceline Air Monitoring Coverage (or Spatial Coverage)	
<input checked="" type="checkbox"/>	<u>Identify the facility’s proximity to sensitive receptors affected by the refinery operation and provide the information below.</u>
	<u>o Distance from facility to closest sensitive receptor(s)</u>
	<u>o Location of downwind and upwind communities</u>
	<u>o Significant sources of non-refinery emissions surrounding the facility (e.g. non-refinery industrial facilities)</u>
	<u>o Dispersion modeling†</u>
<input checked="" type="checkbox"/>	<u>Describe historical facility emission patterns and pollutant hotspots based on the following:</u>
	<u>o On-site location of operations and processes within the facility’s perimeter</u>
	<u>o On-site location of emissions sources and level of emissions</u>
	<u>o Facility plot plans and topography</u>
	<u>o Dispersion modeling†</u>
<input checked="" type="checkbox"/>	<u>Select sampling locations along the perimeter of the facility based on the information above. Also, provide the following:</u>
	<u>o Locations where equipment will be sited (e.g., GIS coordinates) and measurement pathways</u>
	<u>o Elevations of equipment and pathways</u>
	<u>o A description of how the monitoring system will provide adequate coverage, especially for all nearby downwind communities</u>
Fenceline Air Monitoring Equipment Description	
<input checked="" type="checkbox"/>	<u>Select fenceline air monitoring equipment that is capable of continuously measuring air pollutants in real-time and provide the following:</u>
	<u>o Specifications for the fenceline instruments (e.g., detection limits, time resolution, etc.)</u>
	<u>o Explanation of the operation and maintenance requirements for selected equipment</u>
	<u>o Justification to use alternative technologies</u>

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<input checked="" type="checkbox"/>	<u>Monitor for the pollutants listed in Table 1 of Rule 1180 or Rule 1180.1 and include the following:</u>
	○ <u>Pollutant detection limits for all instruments and the defining factors, such as paths measured for open path systems</u>
	○ <u>Justification of any exclusion of chemical compounds listed in Table 1 of Rules 1180 and 1180.1 or measurement of a surrogate compound</u>
<u>Quality Assurance</u>	
<input checked="" type="checkbox"/>	<u>Develop a Quality Assurance Project Plan (QAPP) that describes the following:</u>
	○ <u>Quality assurance procedures for data generated by the fenceline air monitoring system (e.g., procedures for assessment, verification and validation data)</u>
	○ <u>Standard operating procedures (SOP) for all measurement equipment</u>
	○ <u>Routine equipment and data audits</u>
<u>Data Presentation to the Public</u>	
<input checked="" type="checkbox"/>	<u>Design a data display website that includes the following:</u>
	○ <u>Educational material that describes the objectives and capabilities of the fenceline air monitoring system</u>
	○ <u>A description of all pollutants measured and measurement techniques</u>
	○ <u>A description of background levels for all pollutants measured and provide context to levels measured at the fenceline</u>
	○ <u>The most recently approved, or partially approved, FAMP and QAPP</u>
	○ <u>Definition of each data quality flag</u>
	○ <u>Report(s) generated from independent audit(s), including corrective action plan(s) or revised corrective action plan(s) if applicable</u>
	○ <u>Root cause analysis</u>
	○ <u>Hyperlinks to relevant sources of information</u>
	○ <u>A means for the public to provide comments and feedback; Procedures to respond</u>
	○ <u>Real-time and historic concentration, which includes at least five years of data, of all air pollutants measured on the fenceline air monitoring system including data quality flags, explains changes due to QA/QC and provides chain of custody information</u>

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	<ul style="list-style-type: none"> ○ <u>Real-time and at least five years of historic concentration wind speed and wind direction data</u>
	<ul style="list-style-type: none"> ○ <u>Quarterly data summary reports, including relationship to notification thresholds, data completeness, instrument issues, and quality control efforts</u>
Notification System	
<input checked="" type="checkbox"/>	<u>Design a notification system for the public to voluntarily participate in that includes the following:</u>
	<ul style="list-style-type: none"> ○ <u>Notifications for activities that could affect the fenceline air monitoring system (e.g., planned maintenance activities or equipment downtime)</u>
	<ul style="list-style-type: none"> ○ <u>Notifications for the availability of periodic reports that inform the community about air quality</u>
	<ul style="list-style-type: none"> ○ <u>Notifications for exceedances in thresholds (e.g. Acute Reference Exposure Levels (RELs))</u>
	<ul style="list-style-type: none"> ○ <u>Communication methods for notifications, such as, automated emails, text messages, and other approved communication methods</u>

† Dispersion modeling shall be conducted using U.S. EPA’s Preferred and Recommended Air Quality Dispersion Model (e.g., Health Risk Assessment)

Appendix B --References and Other Resources

- [1] OEHHA, "Analysis of Refinery Chemical Emissions and Health Effects," March 2019. [Online]. Available: <https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf>.
- [2] RTI International and EC/R Incorporated, "Gas Chromatograph (GC) Evaluation Study," 2014.
- [3] M. R. a. D. B. Franck Amiet, "Continuous Monitoring of Polycyclic Aromatic Hydrocarbons Using Automatic Thermal Desorption-Gas Chromatography," 2016.
- [4] South Coast Air Quality Management District, "Optical Remote Sensing Studies," 2015. [Online]. Available: <http://www.aqmd.gov/ors-study>.
- [5] U.S. EPA, "Quality Assurance Handbook for Air Pollution Measurement Systems," 2008. [Online]. Available: https://www.epa.gov/sites/default/files/2021-04/documents/volume_iv_meteorological_measurements.pdf.
- [6] U.S. EPA, "Guidance for Quality Assurance Project Plans," December 2002. [Online]. Available: <https://www.epa.gov/sites/default/files/2015-06/documents/g5-final.pdf>.
- [7] OEHHA, "OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary," August 2020. [Online]. Available: <http://www.oehha.ca.gov/air/allrels.html>.
- [8] U.S. EPA, "EPA Handbook: Optical Remote Sensing for Measurement and Monitoring of Emissions Flux," December 2011. [Online]. Available: <https://www3.epa.gov/ttnemc01/guidInd/gd-052.pdf>.

Bay Area Air Quality Management District, 2016. Air Monitoring Guidelines for Petroleum Refineries.

<http://www.baaqmd.gov/~media/files/planning-and-research/public-hearings/2016/9-14-and-12-15/042016-hearing/1215-amg-041416-pdf.pdf?la=en>

Bay Area Air Quality Management District, 2016. Regulation 12, Rule 15: Petroleum Refining Emissions Tracking.

[\[http://www.baaqmd.gov/~media/files/planning-and-research/rules-and-regs/reg-12/rg1215-pdf.pdf?la=en\]](http://www.baaqmd.gov/~media/files/planning-and-research/rules-and-regs/reg-12/rg1215-pdf.pdf?la=en)

U.S. EPA, 2015. AP-42: Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Chapter 5: Petroleum Industry.

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[<https://www3.epa.gov/ttn/chief/ap42/ch05/index.html>]

U.S. EPA, 2015. 40 CFR §63.658, Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, Final Rule.

[<https://www.gpo.gov/fdsys/pkg/FR-2015-12-01/pdf/2015-26486.pdf>]

U.S. EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5, EPA/240/B-01/003)

[https://www.epa.gov/sites/production/files/2016-06/documents/r5-final_0.pdf]

U.S. EPA Guidance for the Data Quality Objectives Process (EPA QA/G-4, EPA/600/R-96/055)

[<https://archive.epa.gov/epawaste/hazard/web/pdf/epaqag4.pdf>]

U.S. EPA Guidance on Technical Audits and Related Assessments for Environmental Data Operations (EPA QA/G-7, EPA/600R-99/080)

[<https://www.epa.gov/sites/production/files/2015-07/documents/g7-final.pdf>]

Network Design for State and Local Monitoring Stations (SLAMS), National Air Monitoring Stations (NAMS), and Photochemical Assessment Monitoring Stations (PAMS).

Code of Federal Regulations. Title 40, Part 58, Subpart E, Appendix D.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Part 1 (EPA-454/R-98-004)

[<https://goo.gl/HGCNrR>]

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/010b)

[<https://www3.epa.gov/ttn/amtic/airtox.html>]

Guidance for Preparing Standard Operating Procedures (SOPs) (EPA QA/G-6, EPA/240/B-01/004)

[<https://www.epa.gov/sites/production/files/2015-06/documents/g6-final.pdf>]

U.S. EPA Handbook: Optical Remote Sensing for Measurement and Monitoring of Emissions Flux

[<https://www3.epa.gov/ttnemc01/guidlnd/gd-052.pdf>]

Draft CARB/CAPCOA Refinery Air Monitoring Assessment Reports

[<https://www.arb.ca.gov/fuels/carefinery/crseam/crseam.htm>]

Draft OEHHA Report: Analysis of Refinery Chemical Emissions and Health Effects

[<https://oehha.ca.gov/air/analysis-refinery-chemical-emissions-and-health-effects>]