# Rule 1180 And Rule 1180.1 Fenceline Air Monitoring Plan Guidelines

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 amended Rule 1180 – Fenceline and Community Air Monitoring for Petroleum Refineries and Related Facilities (Rule 1180) and adopted Rule 1180.1 – Fenceline and Community Air Monitoring for Other Refineries (Rule 1180.1) on January 5, 2024. 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 refineries and related facilities. For the purpose of this guidance document, the term facility will be used to refer to petroleum refineries and related facilities subject to Rule 1180 and refineries subject to Rule 1180.1.

Rules 1180 and 1180.1 require that facility owner or operators submit a written Fenceline Air Monitoring Plan (FAMP) for establishing and operating a real-time fenceline air monitoring system. South Coast AQMD staff developed these Guidelines to serve as a written framework to be used by the Executive Officer to evaluate FAMPs required by Rules 1180 and 1180.1. In addition, these Guidelines inform facility owners or operators about the elements necessary to complete a FAMP.

South Coast AQMD recognizes the need for flexibility when designing a FAMP, therefore, each plan will be evaluated on a case-by-case basis and should be tailored to each facility's size, operations, specific location, and surrounding receptors. 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 facility fenceline, whenever feasible. Rule 1180.1 is similar to Rule 1180 in its air monitoring requirements; therefore, staff revised existing Rule 1180 Guidelines to include guidelines for Rule 1180.1. The guidelines provide criteria that would be used to allow the exclusion of certain types of monitoring.

Rules 1180 and 1180.1 require that FAMPs and quality assurance project plans (QAPPs) provide detailed information about the installation, operation, 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 facility; data systems that process and store historical data; and public web-based fenceline data display and notification systems, where data are displayed and through which public fenceline notifications are issued. An effective fenceline air monitoring system shall be capable of measuring concentrations at the fenceline from routine emissions and leaks, as well as unplanned releases from facility equipment and other sources of facility-related emissions. For this purpose, fenceline air monitoring system must cover the entire facility. The fenceline air monitoring system would inform facility operators and the public about potential air pollution impact to nearby communities. The following diagram (Figure 1) outlines the facility fenceline program. Each of the parts will be discussed in this guidance document.

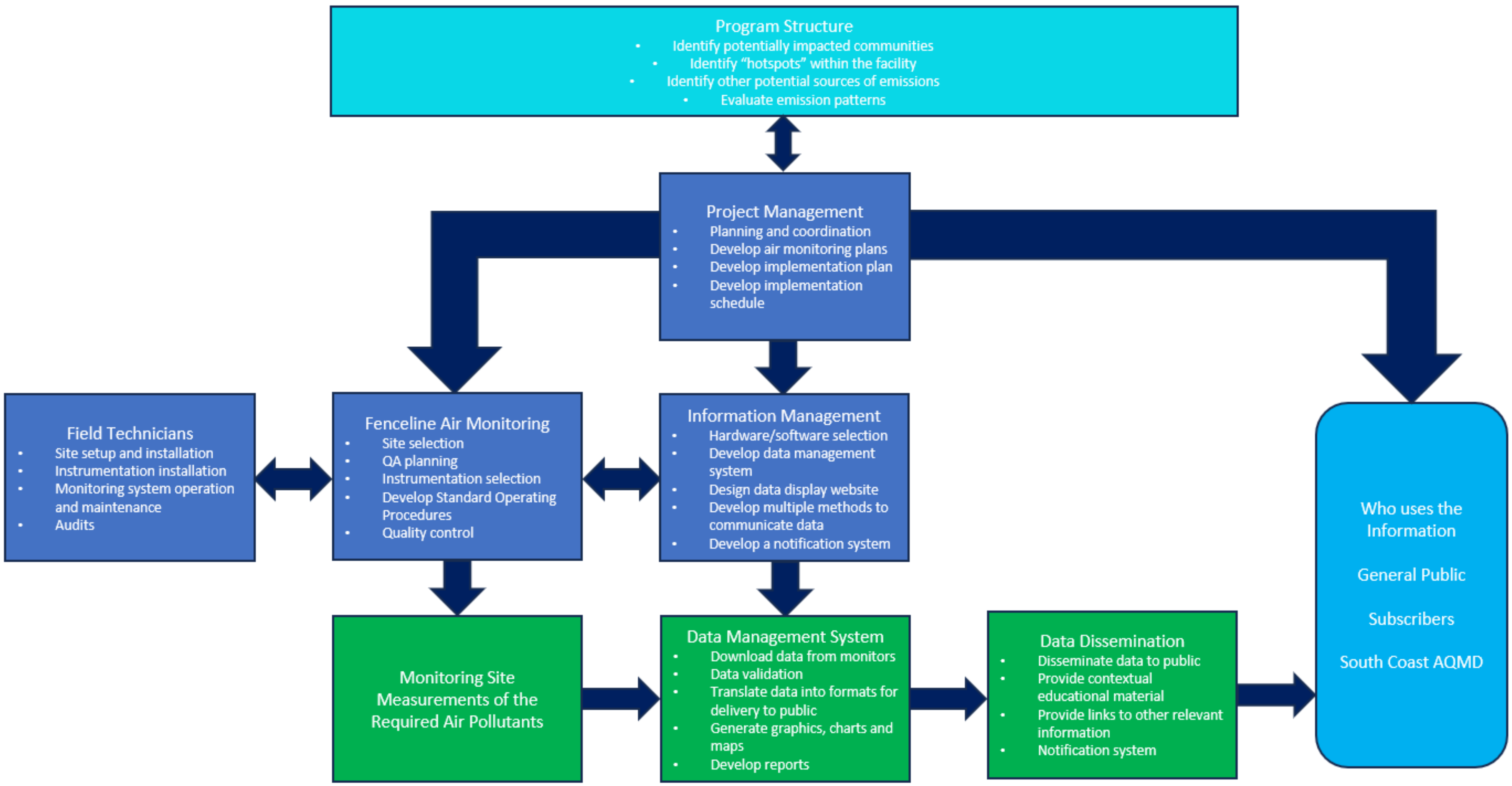


***Figure 1:* Overview of the Facility Fenceline Air Monitoring Programs**

## 2. Fenceline Air Monitoring Plan

There are three main steps in developing a FAMP: (1) identifying emissions sources and affected communities, (2) developing 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 2 - Overview of Key Steps to Developing a FAMP) outlines these steps.

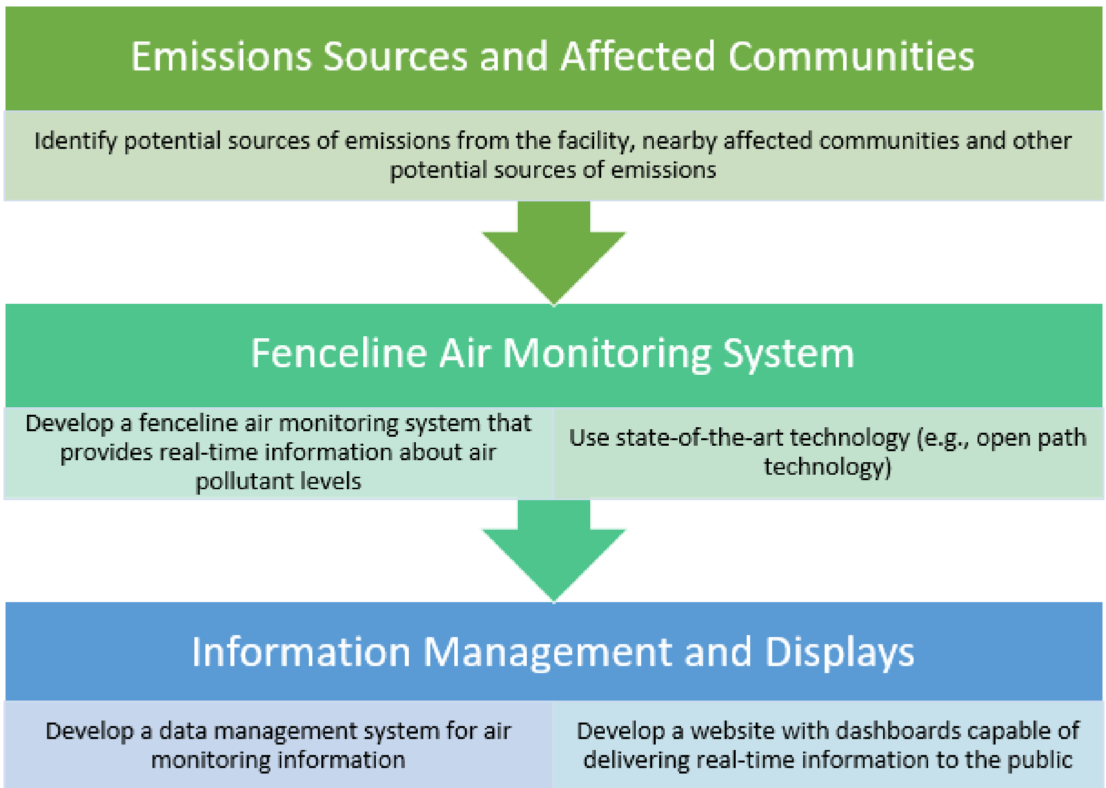


***Figure 2*: Overview of Key Steps to Developing a FAMP**

A fenceline air monitoring plan shall meet the following key objectives:

- Provide measurements of various air pollutant levels (i.e., air pollutant concentration) in real-time (when feasible) and in short enough time resolutions to adequately address significant emissions changes from facility operations;
- Gather accurate meteorological data to identify factors that may impact air pollutant levels near facility operations;
- Track long-term air pollutant levels, variations, and trends over time at or near the property boundaries of refineries;
- Provide context to the data so that local communities can understand differences (if any) in air quality in their location from other locations in the Basin and understand the potential health impacts associated with local air quality near facility operations;

- Notify subscribers when emissions exceed pre-determined thresholds (e.g., the relevant health-based notification standards or information-based notification standards listed in the rules); and
- Provide quarterly reports summarizing the measurements, data completeness, and quality assurance.

Thus, a FAMP shall address these objectives.

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

- An evaluation of routine emission sources at the facility (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 facility to determine potential emission sources and their location;
- 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 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;
- Details of the public notification system; and
- Independent audit.

This information will be used by the Executive Officer to determine whether to approve the FAMP and QAPP during the plan review process set forth in Rules 1180 and 1180.1.

## 3. Fenceline Air Monitoring Systems

Development of a fenceline air monitoring system shall consider the geospatial layout of the facility 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. Fenceline air monitoring systems should achieve maximum possible fenceline coverage, whenever feasible.

Details about each of these key considerations are explained below.

**Multi-Pollutant Monitoring**

The purpose of Rules 1180 and 1180.1 is to provide air quality information to the public regarding levels of certain air pollutants such as criteria air pollutants, volatile organic compounds, metals, and other air pollutants, at or near the facility property boundaries and in nearby communities. Multi-pollutant monitoring provides air quality information for multiple air pollutants and, therefore, can broaden the understanding of air quality conditions and pollutant interactions. This can further the capabilities of evaluating air quality models, development of emissions control strategies, and support research (i.e., health studies). Refineries and activities associated with them emit a wide range of air pollutants, including criteria pollutants (sulfur dioxide ($SO_2$), nitrogen dioxide ($NO_2$), carbon monoxide (CO), and particulate matter (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., nickel, cadmium, manganese) and other air pollutants (e.g., hydrogen sulfide, carbonyl sulfide, and particulate matter).

All air pollutants list in Table 1 from the applicable rule, e.g., Rule 1180 or Rule 1180.1, shall be identified in the FAMPs. Exclusion of any of these air pollutants identified in Table 1 of the rules must be thoroughly explained and justified in the facility's FAMP. Other chemicals may also be detected 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.

**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, which is part of CalEPA, published a report in March 2019. The report presented 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. Those at or near the top of the list would be top candidates for air monitoring near

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

refineries. 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 chemical compounds of interest for Rules 1180 and 1180.1 are based on the2019 OEHHA report as presented in Table 1 below, however, black carbon and the metal compounds are not required to be monitored by Rule 1180 related facilities and Rule 1180.1 refineries.

**Table 1 - Refinery-Related Air Pollutants to be Addressed by FAMPs**

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

*When real-time monitoring is feasible

**Not required for Rule 1180 related facilities and Rule 1180.1 refineries

***Sulfur Dioxide ($SO_2$)***

Heating and burning of fossil fuel release the sulfur present in these materials and result in the formation of $SO_2$. $SO_2$ is the criteria pollutant that is the indicator of SOx concentrations in the ambient air and can have direct health impacts and can cause damage to the environment. As a result, $SO_2$ is routinely measured in ambient air monitoring networks. The major sources of $SO_2$ at refineries are fuel fired in furnaces and boilers, Fluid Catalytic Cracking units (FCCUs), Sulphur Recovery Units, flares, etc. As a result, measurement of this compound will help identify potential contribution of refineries to the ambient concentrations of $SO_2$ in nearby communities.

***Oxides of Nitrogen (NOx)***

Both gasoline and diesel-powered vehicles are the main source of NOx emissions; however, substantial emissions are also added by stationary sources such as refineries. NOx includes nitric oxide (NO) and $NO_2$, a group of highly reactive gases that contribute to the formation of secondary particulate matter, as well as tropospheric ozone. Scientific evidence links $NO_2$ 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. Measurement of these constituents will help determine if refineries add significant concentrations of NOx to nearby urban environments.

***Particulate Matter ($PM_{10}$ and $PM_{2.5}$)***

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 $PM_{10}$.

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 $PM_{2.5}$, $PM_{10}$, 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. VOCs are emitted by a variety of sources, but many hydrocarbons are associated with fuels and the production of fuels and 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. Facilities are required to measure fenceline concentrations of total VOCs and specific VOCs listed in Table 1 of the respective rule using Open Path Ultraviolet Differential Optical Absorption Spectroscopy (UV-DOAS) and Fourier Transform Infrared Spectroscopy (FTIR) technologies unless other technologies have been approved in the facility's FAMPs.

Table 1 of the respective rules, lists specific VOCs that must be monitored. These VOCs represent facility fugitive emissions and/or health risk drivers. In addition to individual VOC concentrations, total VOC measurements are also required at the facility fenceline. Total VOCs in this guideline is described as Non-Methane Hydrocarbons, and CARB defines Non-Methane Hydrocarbons as the sum of all hydrocarbon air pollutants except methane[2]. Various hydrocarbon species absorb strongly around the 3000 cm-1 infrared spectral region. The absorption features of these hydrocarbons are similar, with the absorption strength scaling to the mass of the alkane species. As a result, Total VOCs can be readily quantified by open path FTIR technology by conducting spectral retrieval in the above-mentioned spectral region (the exact retrieval spectral window may vary slightly by vendor and retrieval approach).

Automated gas chromatographs (auto-GCs) offer sub-ppb sensitivity for monitoring of select VOCs semi-continuously (for example, hourly time resolution, with data for previous hour being available within 15-20 minutes past the hour). This technology has been developed by several manufacturers. The U.S. EPA has evaluated the current state and availability of several commercially available auto-GCs in order to determine their suitability for use in air monitoring stations and has published the results in the Photochemical Air Monitoring Station (PAMS) Gas Chromatography Evaluation Study Report[3]. Other emerging methods for continuous measurement of selected VOCs include, but are not limited to, DOAS and FTIR optical analyzers. These instruments 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. However, a substantial number of these auto-GCs and/or point monitors would need to be deployed to achieve sufficient spatial coverage along the property boundary of a facility. For this reason, open-path technologies used at the fenceline air monitoring of VOCs at the facility fenceline is preferred.

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 potential compounds of interest and techniques to measure and/or analyze them are described below.

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[2] California Air Resources Board Glossary available at https://ww2.arb.ca.gov/about/glossary

[3] RTI International and EC/R Incorporated, "Gas Chromatograph (GC) Evaluation Study," 2014 available at https://www.epa.gov/sites/default/files/2019-11/documents/labevalreport.pdf

### *Aldehydes*

Aldehydes emitted into ambient air include, but are not limited to, formaldehyde, acetaldehyde, and acrolein. These three aldehydes are identified as toxic air contaminants (TACs) and could be emitted from a facility. These aldehydes 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 aldehydes 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*

Benzene, toluene, ethylbenzene, and xylenes, referred to as BTEX, are aromatic hydrocarbons that occur naturally in crude oil and are associated with emissions from refineries. The BTEX compounds are products of incomplete combustion of natural gas, and can also be emitted as fugitive emissions from petroleum storage and transfer. Emissions also occur from other combustion sources, such as wood combustion, and stationary and motor vehicle fossil fuel combustion. Elevated levels of BTEX compounds are expected in the vicinity of major roadways. Monitoring the concentrations of this group of aromatic VOCs is important because they pose a risk to human health and play a role in the 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, and automatic-GC monitors. Optical methods such as Open Path UV-DOAS and Open Path FTIR monitors are more advanced techniques for real-time measurements; UV-DOAS instruments are more sensitive at detecting BTEX compounds at low concentrations compared to Open Path FTIR instruments, and should be used for fenceline monitoring of BTEX. In the future, as technologies evolve and improve, it is possible that instruments other than UV-DOAS will improve to achieve similar detection limits.

### *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; therefore, these chemicals must be measured and reported. A more detailed list of VOCs with potential health concerns is provided by the OEHHA. In addition, the AB 2588 Health Risk Assessment reports could assist in identifying other air toxics specifically emitted at each facility. Depending on emissions from each facility, measurement of other volatile air toxics may be appropriate, including, but are not limited to, methanol, phenol, naphthalene, and hexane.

### *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 would be capable of monitoring naphthalene.

***Diethanolamine***

Diethanolamine is a hydrocarbon found in air, water vapor, and particulate phases and has been detected at multiple refinery process units. Diethanolamine can be detected in air by drawing the air sample through sampling tubes for analysis with gas 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 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 in the Office of Environmental Health Hazard Assessment report, "Analysis of Refinery Chemical Emissions and Health Effects," finalized in March 2019 (OEHHA report). 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 PAHs[4]. However, at the time of this writing, staff is not aware of any real-time technology for fenceline monitoring. Staff will report to the Stationary Source Committee when Polycyclic Aromatic Hydrocarbons (PAHs) real-time monitoring is deemed feasible and provide guidance on the installation, operation, and maintenance of the real-time monitoring system before the Executive Officer provides a facility written notice for revising the FAMP to include PAHs real-time fenceline monitoring.

***Metals: Cadmium, Manganese, and Nickel***

Cadmium, manganese, and nickel are identified in the OEHHA report as candidates for air monitoring. Their toxicity-weighted emission scores make them among the highest priority air pollutants to be monitored at the refineries. Exposure to and bioaccumulation of metals have been shown to lead to numerous health problems. Those metals are associated with many facility process units. For example, manganese emissions could be associated with boilers, cooling towers, crude units, heaters, storage tanks, cokers, 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 a refinery ESP failure or explosion that resulted in a large amount of

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

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 ($H_2S$)***

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 occur 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 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 shall be measured and reported at the fenceline.

***Ammonia ($NH_3$)***

While the main sources of ammonia are natural, primarily from the decay of organic matter, 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. Ammonia can be measured using open-path technologies and shall be measured and reported at the fenceline.

***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 $PM_{2.5}$ 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 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, BC is measured using point sensor technologies so full fenceline coverage is not achievable. For this reason, the petroleum refinery owners or operators are required 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.

***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 already have monitors in place for detecting HF, such as could be associated with an accidental release. 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 for the protection of facility workers and the nearby communities in the vicinity of the facility. All facilities that use hydrogen fluoride must monitor the ambient concentrations of HF 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℃; 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.

**Criteria for Exclusion**

In certain cases, the facility owner or operator can request to exclude a compound identified in Table 1 if:

- The compounds are not associated with the processes at the facility:
  - A facility that does not store or use hydrogen fluoride;
  - A facility that does not have a FCCU, which is considered the only source of high concentrations of cadmium, manganese, and nickel which could be emitted as part of spent catalyst; or
  - A facility, such as a tank terminal, which does not have combustion equipment; or
- Technologies are not yet developed to perform real-time monitoring for the compound (e.g., PAHs). 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; or

- Other technical justifications approved by the Executive Officer.

**Continuous and Real-Time Measurement of Air Pollutants**

Continuous air monitoring at or near the property boundaries of refineries can significantly improve rapid detection and communication of potential hazardous releases to facility owner or operators, responders, and the public in addition to providing long-term data, which would be used to determine trends in air quality near refinery fenceline (e.g., diurnal, seasonal variations), and provide additional insight into facility emissions. Therefore, the fenceline monitoring equipment shall be operated continuously with a 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 facility personnel and the nearby communities. Due to the configuration of some open-path systems, e.g., an optical tent monitoring system or open path fenceline air monitor on a panning head, the measurements cycle for each fenceline path might take longer. The optical tent is a novel remote sensing system employing dual scanning Long-Path Differential Optical Absorption Spectroscopy (LP-DOAS), currently operational at a refinery in South Coast AQMD. Comprising of two open-path instruments, each scanning five light paths, this system continuously measures concentrations of selected VOCs along the refinery fenceline and inside the refinery. Such set-up provides benefits of early detection of pollution plumes, in certain instances before they reach the refinery fenceline; and augmented ability to pin-point the source(s) of unwanted emissions within the refinery. If achieving the desired time-resolution is not feasible, facility owner or operators shall provide rationale in the FAMP for any proposed averaging time greater than five minutes (e.g., based on the equipment employed; the reasons for selecting such equipment; the number of paths covered by each open-path system; other potential benefits of the proposed measurement set-up; or other operational justifications).

**Selection of Fenceline Air Monitoring Technologies**

A facility fenceline air monitoring system is a combination of equipment that measures and records air pollutant concentrations at or near the property boundary of a facility. 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, increasing the chances of missing emissions hotspots or emissions plumes. Even after collecting data from multiple points in the survey area, 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 monitoring systems require a clear line of sight along the fenceline in order to provide accurate measurements. If facility demonstrates that such line of sight is not available, a facility may request approval to install point sensors instead of open path monitoring systems at selected portions of the fenceline.

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 concentrations at 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 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; 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 monitoring applications over large areas that are not conducive to traditional point source testing methods. Improvements often include changes to technologies that improve detection limits, or the type of compounds detected.

A path-averaged monitoring approach presents another advantage of open-path measurements of monitoring fugitive emissions at or near the property boundary of a facility operation. Fugitive emissions are emissions of gases or vapors from leaks and other unintended or accidental releases of 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. 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 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. In addition, South Coast AQMD conducted a comprehensive ORS technology demonstrations study to assess open-path capabilities for fenceline air monitoring[5].

In summary, for fenceline monitoring, open-path technologies offer more advantages compared to traditional point monitors. They provide continuous, real-time measurements of multiple pollutants along an open path thus enhancing its temporal and spatial coverage. This kind of coverage might not be possible with conventional point monitors. With the ability to monitor

[5] South Coast Air Quality Management District, "Optical Remote Sensing Studies," 2015. [Online]. available at http://www.aqmd.gov/ors-study.

fugitive emissions across a wider area, open-path systems showcase a greater efficacy in identifying and addressing potential leak sources, therefore, making open-path technologies a more effective long-term solution for facility fenceline air monitoring. 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 available, and appropriate for implementing a fenceline air monitoring system required by Rules 1180 and 1180.1. For open path monitoring systems, if the fenceline does not provide a clear line of sight, it may pose an infeasible condition for optimal open path measurements. In this case, the facility may request approval to install point sensors instead of open path monitoring systems.

The 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 Detection Limits (MDLs) or Method Quantification Limits (MQLs)) for Rule 1180 or Rule 1180.1 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 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 spectra, background and reference spectra and any other data used for concentration retrievals, and associated average concentrations of measured pollutants for retrospective investigations. 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 FAMP. In certain instances, a 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 for certain pollutant(s) that are monitored.

**Alternative Fenceline Air Monitoring Technologies**

In certain instances, alternative monitoring technologies may be appropriate to cover areas along the perimeter of a facility (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 facility owner or operator may propose an alternative air monitoring technology. The facility owner or operator must demonstrate the proposed alternative air monitoring technology will meet the requirements of Rules 1180 and 1180.1 and provide adequate sensitivity and temporal and spatial coverage for the compounds identified in Table 1.

**Fenceline Sampling Location(s) and Coverage**

The FAMP must achieve the complete fenceline, where feasible, spatial coverage, whenever feasible, and provide the following information related to the locations selected for the fenceline air monitoring equipment:

1. Areas along the perimeter that are likely to detect compounds associated with facility operations;
2. Locations of facility equipment or operations that may be emitting these compounds;
3. Proximity of proposed fenceline monitoring equipment to residences in the community and other sensitive receptors, such as schools, day care centers, hospitals, clinics, nursing homes, and recreation areas;
4. Where equipment will be sited (e.g., GIS coordinates);
5. Elevations at which equipment will be placed;
6. Length of each path that will be monitored with fenceline instruments; and
7. A map of the facility indicating where the proposed monitors will be located.

The FAMP must provide the rationale for the siting of the facility fenceline monitoring equipment. The facility owner or operator must address key considerations when siting the monitoring equipment, such as, the spatial coverage of monitors needed to detect emissions and critical transport areas around the perimeter of the facility. 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 facility, the fenceline air monitoring system shall be designed considering the following key factors: local meteorological conditions, topography, pollutant hotspots, spatial coverage of monitors, and emerging technologies.

***Local Meteorological Conditions***

Meteorological conditions can significantly affect the concentration of air pollutants in a region, therefore, it is important that the facility owner or operators 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 owner or operator should ensure the equipment for the fenceline air monitoring system is not sensitive or easily impeded by low-lying cloud cover, and that visibility is being monitored.

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 facility emissions to the surrounding communities. Often, peak concentrations occur during stable, low wind speed conditions when pollutants can build up and drift in any direction, highlighting the importance of complete or near-complete fenceline coverage, where feasible. To the extent feasible, both long- and short-term wind measurements shall be assessed in the 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 because pollutants can become trapped in low lying areas under certain weather conditions. Therefore, the topography of the facility can affect the distribution and dispersion of pollutants from facility operations. The fenceline air monitoring system sited at the most critical transport and dispersion areas along the perimeter of the facility would increase the likelihood for detection of fugitive emissions. The facility owner or operator should consider the topography of the facility when siting the fenceline air monitoring equipment such that the monitors are placed at locations and altitudes to maximize the likelihood of detecting pollution plumes crossing the facility fenceline.

***Pollutant Hotspots***

Facility owners or operators must identify potential pollutant hotspots within the facility to ensure fenceline monitoring of these emissions. This process ensures effective information dissemination to neighboring communities with adequate spatial coverage. In developing the FAMP, the facility 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 shall be designed to ensure adequate coverage of the area along the facility perimeter, to the extent feasible. Considerations, such as the proximity of facility emissions sources to sensitive receptors (i.e., residents, schools, hospitals, etc.) and type of pollutants to be measured could require additional 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. Information available from dispersion modeling, gradient sampling, and mobile measurements, should also be considered 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 the 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 structures and have an open, unobstructed path. Each air monitoring path should have an unobstructed line of sight, 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 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 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 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.

**Emerging Technologies**

Some emerging next generation monitoring technologies might meet the requirements for Rules 1180 or 1180.1. For example, it is possible that $PM_{2.5}$ low-cost sensors could one day allow cost-effective, real-time monitoring at numerous fixed locations along the perimeter (i.e., the fenceline) of a facility. Despite substantial progress, at this time, none of these methods can provide the level of sensitivity and accuracy necessary to measure the air pollutants listed in Table 1 at the levels at or below the health-standard based notification thresholds. However, gaseous sensors may improve in the future, at which point the FAMPs would be revised to include the potential use of these sensors. South Coast AQMD would consider approving emerging technologies in the future.

## 4. Meteorological Measurements

Exposure 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 pose significant challenges for the analysis of data from air quality monitoring programs and exposure assessments. An understanding and assessment of the general meteorological patterns in and around each facility is a critical component in the design of the measurement systems and when interpreting the measurement results, including the transport and dispersion of air pollutants from the facility 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.

The 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 pollutant 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[6].

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

Facilities must ensure that the data is high quality. The FAMP shall address:

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

A QAPP for each facility fenceline monitoring project must outline the QA/QC plan, following U.S. EPA guidelines[7]. 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 shall provide clear definitions and procedures in the QA/QC plan for facilities to determine when data is missing, suspect, or invalid.

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

- **Project Background and Management:** The QAPP shall provide background information and the general goals of the fenceline monitoring system, including:
  - Organization tree that provides all personnel working on the project;
  - Quality objectives and acceptance criteria for measurement data; and
  - Plans for documentation, record keeping, and data dissemination.
- **Technical Approach:** The QAPP shall demonstrate that the appropriate approaches and methodologies are employed for data measurements and data handling.
- **Assessment/Oversight:** The QAPP shall provide appropriate QA/QC steps for ensuring the effectiveness of the monitoring plan. It shall cover experimental design; representativeness of the data; instrument operation and data acquisition; calibration check procedures, data quality indicators, independent performance audits; and peer review.

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

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

- **Data Validation and Usability:** The QAPP shall describe what steps shall 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, and archived in a standard electronic format as approved by the Executive Officer 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, but are not limited to:

- Automatically retrieving data from the fenceline monitors containing the measured levels of each air pollutant along with meteorological data from the meteorological stations and data from visibility monitors;
- 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 when measured concentrations are above 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, SOPs must be prepared for each specific measurement method. The SOPs 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 shall address calibration procedures and quality control procedures; including standards and checks, acceptance criteria, and schedule); and data reduction procedures; including validation procedures, reporting, and schedule.

Rules 1180 and 1180.1 require that measurements from the fenceline monitoring system be available to the public in real-time, with implemented QA/QC measures to ensure confidence in the data. Publicly available quarterly measurement reports 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 downtimes or malfunctions 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.

### 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 facility 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 in the second quarter of 2024, followed by audits initiated later in 2024. The audit protocol, or some portions of the protocol, developed through this process will also be used as the basis for conducting an independent audit for facilities subject to Rule 1180.1, and for periodic ongoing independent audits of facilities subject to Rule 1180 and 1180.1.

Rules 1180 and 1180.1 require recurring 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.

Audit reports shall be signed 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 facility within 90 days after the audit has been performed. The qualified independent party shall certify under the 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.

### 7. Data Display and Dissemination

The primary goal of Rules 1180 and 1180.1 is to collect real-time air pollutant data and share that data with the community, local responders, and industry, to the extent feasible and as quickly as possible, so that they can use the data to evaluate and adaptively manage the impacts of refineries' emissions on the community. It is essential that the collected data 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 and corresponding MDLs, 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 air monitoring data must be provided in a manner that the public can readily access and understand. Websites for all facilities shall be designed in a user-friendly format. In order to make the data provided 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 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.

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, in a real-time or near-real-time manner, in an approved format. The facility owner or operators must also publish quarterly reports, specific cause analysis, and other information specified by Rules 1180 and 1180.1 subdivision (h) on the data dissemination website. The FAMP must include information and examples of how the quality-controlled data will be displayed and provide context to the real-time measurements to the public. Also, the FAMP shall address means for providing automated, reliable, useful, and understandable information, including, any limitations in 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 for the five most recent calendar years 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-near time and historical data available to the Executive Officer in an approved format.

**c. Quarterly Report**

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

- Calibration data;
- Data consistency;
- Field data sheets and logbooks;
- Instrument performance checks;

- Equipment maintenance documentation; and
- Calibration forms.

**d. Specific Cause Analysis**

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

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

## 8. Notification System

The website shall offer an opt-in notification system that is integrated with the data collected by the air monitoring network. The notification system shall automatically generate and issue notifications to subscribers when the concentration of any pollutant exceeds the corresponding threshold pursuant to the approved FAMP.

For text message notifications, the subscriber shall be able to opt-in to receive notifications via a short message service (SMS) or multimedia message service (MMS). A disclaimer must be provided, indicating that the subscriber may be subject to fees based on their phone service provider. The disclaimer must also indicate that messages may be delayed or not received based on their phone coverage. A mechanism to opt-out of the text message notifications is also required. The subscriber is responsible to opt-out of the text message notifications if they desire to do so.

**a. Notification Thresholds**

In establishing health-standard based notification thresholds, 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) by California Office of Environmental Hazard Assessment[8]. 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 notification 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. This notification threshold will indicate when air pollutant measurements are well above the levels typically detected at the

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

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 limits. South Coast AQMD was not able to develop informational based thresholds for naphthalene, PAHs, and cadmium as there is no historical data available. Regarding Black Carbon, given its inclusion as part of the $PM_{2.5}$ measurements with established notification thresholds based on health standards, the staff is not currently considering proposing an informational-based notification threshold specifically for Black Carbon.

The table below lists the health standard-based or informational-based notification threshold for each 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 $PM_{2.5}$ and $PM_{10}$. 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.

***Table 2 Air Pollutants and Notification Thresholds****

| Air Pollutants | Health Standard-Based Notification Threshold (ppb) | Information-Based Notification Threshold (ppb) |
|---|---|---|
| Criteria Air Pollutants | | |
| Sulfur Dioxide | 75 | N/A |
| Oxides of Nitrogen | 100 | N/A |
| Particulate Matter | 35 μg/m³ ($PM_{2.5}$) and 50 μg/m³ ($PM_{10}$) (24-hr) | |
| Volatile Organic Compounds | | |
| Total VOCs (Non-Methane Hydrocarbons) | N/A | 730 |
| Formaldehyde | 44 | N/A |
| Acetaldehyde | 260 | N/A |
| Acrolein | 1.1 | N/A |
| 1,3 Butadiene | 297 | |
| Naphthalene | N/A | N/A |
| Polycyclic aromatic hydrocarbons (PAHs) | N/A | N/A |
| Styrene | 5,000 | N/A |
| Benzene | 8 | N/A |
| Toluene | 1,300 | N/A |
| Ethylbenzene | N/A | N/A |
| Xylenes | 5,000 | N/A |
| Metals | | |
| Cadmium | N/A | N/A |
| Manganese | 0.17 μg/m³ (8-hr) | N/A |
| Nickel | 0.2 μg/m³ | N/A |
| Other Compounds | | |
| Hydrogen Sulfide | 30 | N/A |
| Carbonyl Sulfide | 270 | N/A |
| Ammonia | 4,507 | N/A |
| Black Carbon | N/A | N/A |
| Hydrogen Cyanide | 309 | N/A |
| Hydrogen Fluoride | 289 | N/A |

*One-hour rolling average data are utilized to determine notification thresholds exceedances, except that eight-hour rolling averages are used for manganese and 24-hour rolling averages are used for $PM_{2.5}$ and $PM_{10}$.

### b. Notification System Design

The notification system shall be designed to provide information to the public, via email, text message, or other approved communication 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 shall notify the public of the following:

- The maximum concentration of the air pollutant detected during the period of an exceedance;
- The notification thresholds of the air pollutant;
- Duration of the exceedance.

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 notifications would also provide information to facility owners or operators so they can rapidly identify and reduce 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.

***Text message notification system***

Refineries are required to offer options for interested parties to opt in or opt out of receiving text notifications when they exceed a notification threshold. Depending on the availability of smartphones at the end user's location, the type of messaging can vary. It could range from receiving simple text messages with up to 160 characters (commonly known as SMS) to receiving longer messages containing links to other websites (e.g., OEHHA Air Chemical Database website) to provide more information in the form of MMS. Therefore, the system shall allow subscribers to opt-in to receive text messages in the form of either SMS or MMS. Interested parties are responsible for re-opting in if their phone numbers change; this is not the responsibility of the notification-issuing facility. The text message notification system should, at a minimum, provide this information:

- For SMS notifications:
  - Facility name, location, site, date, and time of the exceedance.
  - Air pollutant name, concentration measured, and the notification threshold.
- For MMS notifications:
  - Include all of the information in the SMS notification.

  - Add a link to the OEHHA Air Chemical Database website for the specific air pollutant detected above the threshold.
  - Add a link to the facility's website that contains additional information about the event.
- Include a disclaimer that text messages are handled by individual cell phone carriers, which is outside the control of the facilities.

## 9. Future Updates to Rules 1180 and 1180.1 Fenceline Air Monitoring Plan Guidelines

Revisions and updates to this guidance are expected as new instrumentation, methodologies and monitoring strategies are developed. The resolution for the 2024 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.

## Appendix A - FAMP Checklist

| FAMP Checklist | |
|---|---|
| **Fenceline Air Monitoring Coverage (or Spatial Coverage)** | |
| þ | Identify the facility’s proximity to sensitive receptors affected by the facility operation and provide the information below. |
| | ○ Distance from facility to closest sensitive receptor(s) |
| | ○ Location of downwind and upwind communities |
| | ○ Significant sources of non-refinery emissions surrounding the facility (e.g. non-refinery industrial facilities) |
| | ○ Dispersion modeling† |
| þ | 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† |

| | |
|---|---|
| þ | 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 provide adequate coverage, especially for all nearby downwind communities |
| **Fenceline Air Monitoring Equipment Description** | |
| þ | Select fenceline air monitoring equipment that is capable of continuously measuring air pollutants in real-time and provide the following: |
| | ○ Specifications for the fenceline instruments (e.g., detection limits, time resolution, etc.) |
| | ○ Explanation of the operation and maintenance requirements for selected equipment |
| | ○ Justification to use alternative technologies |
| þ | Monitor for the pollutants listed in Table 1 of Rule 1180 or Rule 1180.1 and include the following: |
| | ○ Pollutant detection limits for all instruments and the defining factors, such as paths measured for open path systems |
| | ○ Justification of any exclusion of chemical compounds listed in Table 1 of Rules 1180 and 1180.1 or measurement of a surrogate compound |
| **Quality Assurance** | |
| þ | Develop a QAPP that describes the following: |
| | ○ Quality assurance procedures for data generated by the fenceline air monitoring system (e.g., procedures for assessment, verification and validation data) |
| | ○ SOP for all measurement equipment |
| | ○ Routine equipment and data audits |
| **Data Presentation to the Public** | |
| þ | Design a data display website that includes the following: |
| | ○ Educational material that describes the objectives and capabilities of the fenceline air monitoring system |

| | |
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| | ○ A description of all pollutants measured and measurement techniques |
| | ○ A description of background levels for all pollutants measured and provide context to levels measured at the fenceline |
| | ○ The most recently approved, or partially approved, FAMP and QAPP |
| | ○ Definition of each data quality flag |
| | ○ Report(s) generated from independent audit(s), including corrective action plan(s) or revised corrective action plan(s) if applicable |
| | ○ Specific cause analysis |
| | ○ Hyperlinks to relevant sources of information |
| | ○ A means for the public to provide comments and feedback; Procedures to respond |
| | ○ Real-time and at least five years of historic concentration data of all air pollutants measured on the fenceline air monitoring system including data quality flags, quarterly reports, audits, etc. |
| | ○ Real-time and at least five years of historic wind speed and wind direction data |
| | ○ Quarterly data summary reports, including relationship to notification thresholds, data completeness, instrument issues, and quality control efforts |
| **Notification System** | |
| þ | Design a notification system for the public to voluntarily participate in that includes the following: |
| | ○ Notifications for activities that could affect the fenceline air monitoring system (e.g., planned maintenance activities or equipment downtime) |
| | ○ Notifications for the availability of periodic reports that inform the community about air quality |
| | ○ Notifications for exceedances of thresholds |
| | ○ Communication methods for notifications, such as, automated emails, text messages, and other approved communication methods |

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

## Appendix B - Other Resources

**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]

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