# AB 617 COMMUNITY AIR MONITORING PLAN (CAMP) FOR THE WILMINGTON / CARSON / WEST LONG BEACH COMMUNITY


**South Coast Air Quality Management District**

**April 2019**

**Version 1**

# CONTENTS

# FIGURES



# TABLES

## Background

Community air monitoring plays an important role in supporting effective actions to reduce emissions and exposure within communities that are disproportionally impacted by air pollution. Assembly Bill (AB) 617, passed by the California legislature in 2017, is a law that focuses on reducing air pollution in Environmental Justice (EJ) communities throughout the State. This law provides an opportunity for the South Coast Air Quality Management District (South Coast AQMD) to further address community air quality issues in disadvantaged areas. For each community approved by the California Air Resources Board (CARB), South Coast AQMD staff will work with a community steering committee (CSC), local stakeholders, and members of the public to assess their major air pollution concerns and propose specific action strategies. Depending on the specific needs of each community, South Coast AQMD staff will develop and implement a tailored Community Emission Reduction Plan (CERP) and a Community Air Monitoring Plan (CAMP). South Coast AQMD staff will work with CARB, state and local agencies, and other stakeholders to implement these CERPs and CAMPs to reduce local air pollution emissions and benefit public health.

The three communities within the South Coast AQMD that were designated by CARB for Year 1 AB 617 implementation are:

- Wilmington / Carson / West Long Beach (WCWLB)
- San Bernardino / Muscoy
- East Los Angeles / Boyle Heights / West Commerce

CARB designated that each of these 3 communities have both CAMPs and CERPs developed during the first year. CAMPs must be submitted to CARB by May 1, 2019. AB 617 specifies that air monitoring within each of these three communities must commence by July 1, 2019. The main purpose of the CAMPs is to outline the air monitoring that will be conducted to address each community's top priority air quality issues and support effective implementation of the CERPs. This could include new monitoring activities, and augmenting ongoing and/or upcoming community-led and agency-led air monitoring programs. These new monitoring activities will enhance the geographical coverage of existing air monitoring activities throughout the South Coast Air Basin (Basin). Air monitoring will also enhance our understanding of pollution impacts in EJ areas. A variety of air monitoring approaches will be used and the objectives, tools, and stakeholders involved will differ from community to community.

This document only discusses the CAMP for the WCWLB community.

## Community Air Monitoring Plan Objectives

This plan was drafted by South Coast AQMD staff for the WCWLB community based on input from the CSC and public. The process and more information about the specific air quality concerns raised during the CSC meeting process are described throughout this document. Comments on the draft CAMP are welcome, and South Coast AQMD staff appreciates all the input provided by the community.

This CAMP is a living document and specific air monitoring objectives and strategies for WCWLB will be added, updated, and modified based on community feedback, air monitoring findings, and knowledge that will be gathered through the process of implementing AB 617 in this community. Therefore, this CAMP is expected to undergo revisions which will be resubmitted to the CSC for input.

Air monitoring in WCWLB will enhance our understanding of sources, pollutants, receptors, and health impacts in this community. The ongoing emphasis of the AB 617 program on community-level assessment through enhanced air monitoring and new emissions reporting requirements will continue to improve our understanding of specific air pollution problems in coming years, which will support the development and implementation of effective emissions reduction strategies (through the CERP) designed to improve local air quality.

To assess the effectiveness of the strategies implemented through the CERP specific mechanisms and metrics to track air quality and exposure progress over time must be selected and implemented. In addition to air monitoring, air quality modeling will also be used to predict air quality concentrations and/or modeled cancer and non-cancer risk. AB 617 requires that the CERP results in tangible emissions reductions, which can be demonstrated based on monitoring or other data. Therefore, while CERP and CAMP are separate documents with different submittal and implementation schedules, they work hand-in-hand to help achieve emission reductions for specific source categories, and track emissions reductions for specific air quality concerns that have been identified by the community. Some of these emissions reduction goals are achieved by working closely with the CSC and the public. Others will be accomplished through interagency collaboration (e.g. South Coast AQMD and CARB will collaborate to support community-level mobile source emissions tracking, as appropriate).

It is important to note, however, that as new air pollution emission strategies are developed and implemented, it may take several years to see significant reductions in exposure that can be measured at the community level. It may also take some time to deploy the monitoring systems necessary to measure these changes and to develop and run community-specific air quality models. These air quality and exposure metrics are, therefore, most appropriate for a final assessment at the five-year milestone mark, though interim assessments and monitoring will be done to help inform all stakeholders.

Air monitoring objectives that are specific to this CAMP include the collection of air pollution data for both short- and long-term air quality assessments. A variety of air monitoring approaches will be used for this purpose. These consists of a combination of real- (or near-real-) time and time-integrated measurements to provide information on the air pollution impact caused by specific emission sources identified in WCWLB, and compare air pollution levels measured in previous health studies, well-known health benchmarks and long-term health reference standards. This comparison and analysis is intended to provide the basis for additional actions, including, but not limited to, additional monitoring, enforcement actions, and other emission and/or exposure reduction efforts.

This CAMP outlines the recommended monitoring methods, approaches and strategies that will be used to support actions towards a better understanding of air quality conditions, emission and exposure reduction to air pollution, and an unbiased assessment of the effectiveness of the CERP over time. The air monitoring activities proposed here will complement and also enhance existing South Coast AQMD and community-led programs, as well as other ongoing and upcoming community-focused monitoring such as that required within South Coast AQMD's Rule 1180 (Refinery Fenceline and Community Air Monitoring)[1]. This rule requires monitoring around the seven major refineries in the Basin (fenceline monitoring) and at 10 community sites downwind of these refineries including multiple locations within

[1] RULE 1180. Refinery Fenceline and Community Air Monitoring. Available at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1180.pdf

the WCWLB area. More details on the objectives of this rule and the benefits to the WCWLB community are provided later in this document. Overall, community air monitoring will generate data to satisfy the recommendations provided in CARB's "Community Air Protection Blueprint" [2] and support a variety of actions, including:

- Identifying sources, categories of emissions, and emission types contributing to air pollution burdens within the community to support the development of a community emissions reduction program;
- Refining air quality information at the community level to track progress towards improved air quality and measure the effectiveness of the community emissions reduction program;
- Providing real-time air quality data to support public health notification systems for residents, inform their daily activities and school flag programs, and protect children during school activities; and
- Providing air quality information to support public health research at the community level.

## Air Quality Concerns in the WCWLB Community

Each community has unique air quality challenges, and local community members have first-hand knowledge of necessary information, including emission sources and sensitive receptor locations. In order to ensure a collaborative process in developing and implementing a successful CAMP, it is critical to understand the specific air quality concerns in the WCWLB community. The CSC meetings provide a forum for identifying community-specific air quality concerns and potential contributing sources of air pollution to develop consensus and a shared understanding of specific air pollution challenges. In addition to the active collaboration with the CSC, the South Coast AQMD engages in a robust public process to provide opportunity for broad engagement both during CAMP development and throughout implementation. This is achieved through periodic community meetings, workshops, South Coast AQMD Committee meetings, and South Coast AQMD Governing Board meetings.

A brief description of topics discussed during past CSC meetings and the level of CSC and community engagement is provided below:

**AB 617 Kick-Off Meeting - October 2, 2018 (Wilmington, CA)**

This meeting focused on current and upcoming initiatives that are relevant to the WCWLB community, including existing and upcoming air monitoring efforts, the CSC and South Coast AQMD roles, and clean air incentives. The meeting included brief presentations, an open house, and a public comment period where community members and the public had the opportunity to get additional information, ask questions, and provide feedback. The information gathered during this meeting helped identify the specific boundaries that will be used to define the WCWLB community for the purpose of AB 617 implementation.

**Community Steering Committee Meeting #1 – October 30, 2018 (Wilmington, CA)**

During this event the discussion focused on air quality monitoring and planning activities, and the role and responsibilities of the CSC. Specific community air quality concerns in WCWLB were identified through a mapping exercise. Committee members, as well as other meeting attendees, discussed their

[2] CARB (2018) *Community Air Protection Blueprint*. Available at: https://ww2.arb.ca.gov/our-work/programs/community-air-protection-program/community-air-protection-blueprint.

concerns regarding emission sources within WCWLB and provided input to understand the community's major air quality concerns.

**Community Steering Committee Meeting #2 – January 10, 2019 (Carson, CA)**

This discussion focused on the results of the mapping exercise conducted during the previous CSC meeting. The CSC and the public drafted a list of air quality concerns within the community (Figure 1 and Table 1) that will be the focus of future air monitoring and planning activities, and will drive the development of both the CERP and CAMP documents. The group also reached an agreement on the proposed community boundaries. Monitoring technologies that will be used for community air monitoring were discussed, along with how air monitoring can be used to achieve specific objectives and provide useful information for improving community air quality.

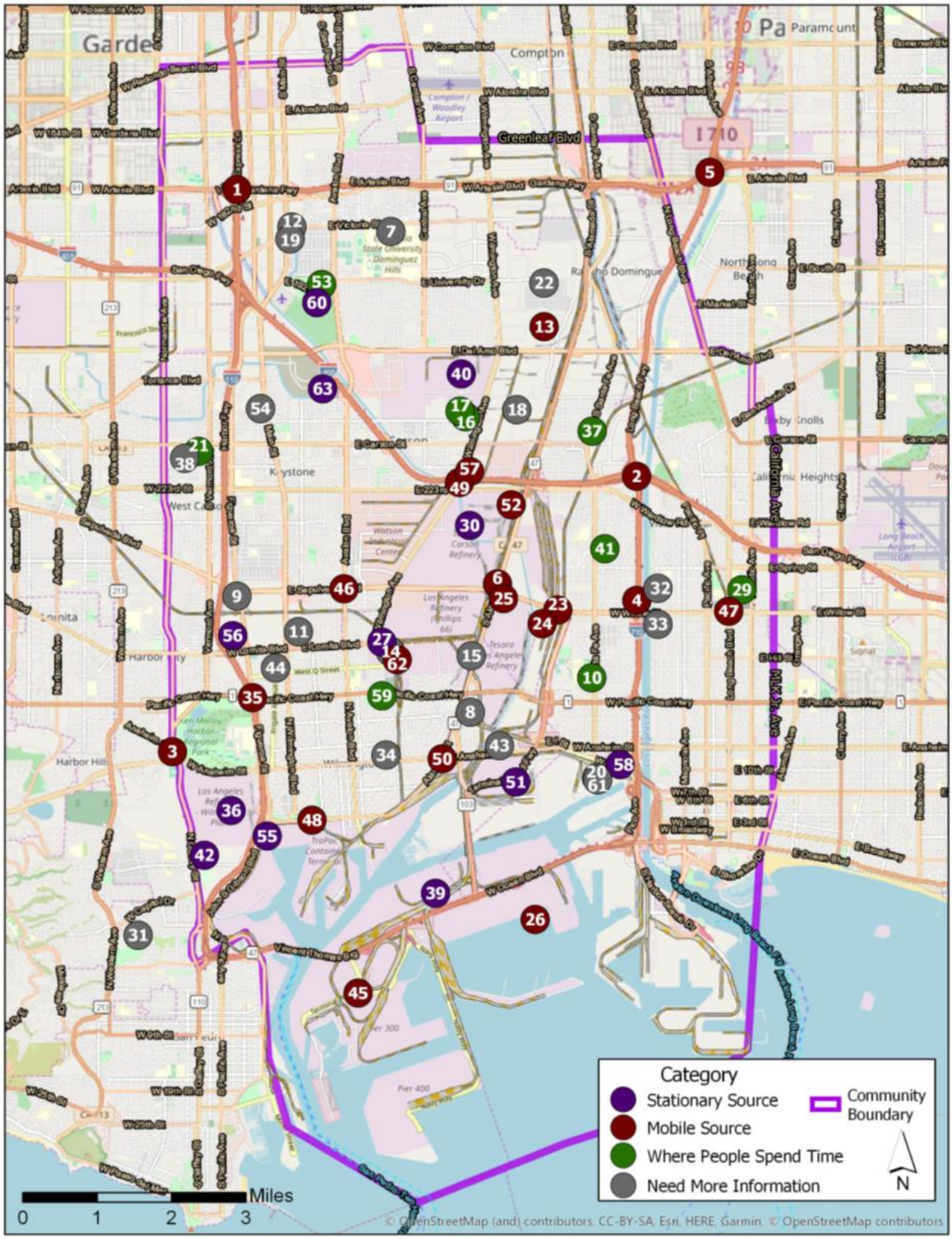


*Figure 1 - Map of Air Quality Concerns within the Community*

*Table 1 - List of Air Quality Concerns within the Community*

| Label | Concern | Category |
|---|---|---|
| 1 | 110/91 and 405/710 Fwy | Mobile Source |
| 2 | 110/91 and 405/710 Fwy | Mobile Source |
| 3 | 5 Points Intersection | Mobile Source |
| 4 | 710 Freeway | Mobile Source |
| 5 | 91/710 Fwy | Mobile Source |
| 6 | Alameda corridor | Mobile Source |
| 7 | Alondra, Storage Container | More Info Needed |
| 8 | Asphalt Plant | More Info Needed |
| 9 | Bixby Marshlands | More Info Needed |
| 10 | Cabrillo High School | Sensitive Receptor |
| 11 | Carousel Tract | Need More Info |
| 12 | Carson Logistics | Need More Info |
| 13 | Carson warehousing district | Mobile Source |
| 14 | Chemical Facility | Stationary Source |
| 15 | Chemical Storage | Stationary Source |
| 16 | Del Amo Elementary | Sensitive Receptor |
| 17 | Dolphin Park | Sensitive Receptor |
| 18 | Dominguez Tech/Distribution Area | Need More Info |
| 19 | Expanding oil wells | Need More Info |
| 20 | Port - Fueling terminals | Need More Info |
| 21 | Harbor UCLA Hospital | Sensitive Receptor |
| 22 | Hazardous Material Sources | Stationary Source |
| 23 | ICTF | Mobile Source |
| 24 | Intermodal facilities | Mobile Source |
| 25 | Kinder Morgan | Mobile Source |
| 26 | LA/Long Beach Port | Mobile Source |
| 27 | Cement/Gravel Yard – Sir Mix Concrete Products | Stationary Source |
| 28 | LGB | Outside Boundary |
| 29 | Miller Children's Hospital, LB Memorial Hospital | Sensitive Receptor |
| 30 | Marathon/Tesoro Refinery | Stationary Source |
| 31 | Military installation | Stationary Source |
| 32 | Oil drilling | Stationary Source |
| 33 | Oil drilling | Stationary Source |
| 34 | Oil production facility | Stationary Source |
| 35 | On/Off Ramp Traffic | Mobile Source |
| 36 | Phillips 66 | Mobile Source |
| 37 | Rancho Dominguez High School | Sensitive Receptor |
| 38 | Rosecrans oil fields | Stationary Source |
| 39 | SERRF - Waste to Energy | Stationary Source |
| 40 | Shell Tank Farm | Stationary Source |
| 41 | Silverado Park | Sensitive Receptor |
| 42 | Storage tanks – Rancho LPG Holdings | Stationary Source |
| 43 | Sulfur pile | Stationary Source |
| 44 | Susceptible Residential Area | Sensitive Receptor |
| 45 | Terminal Island | Mobile Source |
| 46 | Traffic - Sepulveda/Avalon | Mobile Source |
| 47 | Traffic East of Transportation Corridor | Mobile Source |
| 48 | Truck traffic - Harry Bridges | Mobile Source |
| 49 | Truck traffic - 405/Wilmington | Mobile Source |
| 50 | Truck traffic – Terminal Isl. Fwy | Mobile Source |
| 51 | Valero Refinery | Stationary Source |
| 52 | Ventura Transfer | Mobile Source |
| 53 | Victoria Park | Sensitive Receptor |
| 54 | Waste Management Transfer Station | Mobile Source |
| 55 | Wastewater discharge point into harbor | Stationary Source |
| 56 | Wastewater treatment facility | Stationary Source |
| 57 | Warehouses, Watson Land Corps | Mobile Source |
| 58 | Wilmington oil fields | Stationary Source |
| 59 | Wilmington Senior Center, Cemetery | Sensitive Receptor |
| 60 | Victoria Golf Course | Sensitive Receptor |
| 61 | Fueling Terminal | Need More Info |
| 62 | Rail – Along Eubank | Stationary Source |
| 63 | Macerich Development | Stationary Source |

***NOTE: These are sensitive receptor locations identified by the CSC and their definition may not necessarily be consistent with that provided by the South Coast AQMD under Rule 1470(b)(60).***

This meeting focused on potential emission reduction strategies that could be developed to improve air quality conditions in this community, as well as South Coast AQMD inspection activities that will be conducted to guide the proposed reduction strategies. A consensus-building group activity to prioritize the air quality concerns in WCWLB was also conducted. The highest priorities identified by the CSC and the public members were refineries (flaring and public notifications, refinery equipment, and storage tank and refinery leaks), ports (ships and harbor craft, and terminals), and neighborhood truck traffic and idling. Additional high priority concerns included oil drilling and production (leaks and odors, and wells and drilling), railyards, and sensitive receptors (schools, hospitals, parks and community centers). This information was used to prioritize the areas within WCWLB were monitoring will be conducted using the strategies described later in this document. A detailed description of the air monitoring prioritization process can be found in one of the following sections.

Overall, these priority concerns identified by the CSC will be the building blocks of both the CERP and the CAMP that are being developed to implement AB 617 in the WCWLB community.

**Technical Advisory Group Meeting #1 – February 27, 2019 (Diamond Bar, CA)**

The AB 617 Technical Advisory Group (TAG) includes three members from each of the three year one CSC groups and additional technical experts from academia, research institutes, governmental agencies, and the members of the public. The TAG was formed to create a forum where CSC members and other stakeholders could discuss more detail on source attribution, air monitoring and other technical topics related to the development of the CERPs and CAMPs.

The first TAG meeting was held at the South Coast AQMD Headquarters in Diamond Bar, California, and the topics discussed included emissions and air quality modeling tools, monitoring technologies and laboratory capabilities available for AB 617 implementation. The TAG members asked questions and provided suggestions for improving community level data, notification systems, and inter-agency collaborations to address air quality concerns in year one communities. The next Technical Advisory Group meeting will be held in the late spring of 2019.

**Community Steering Committee Meeting #4 – March 14, 2019 (Wilmington, CA)**

During this meeting the group discussed Indirect Source Rules (ISR) and Best Available Retrofit Control Technology (BARCT), the proposed air monitoring approaches that will become part of the CAMP, and initial concepts for CAMP and CERP strategies to address the top three community air quality concerns in WCWLB, namely: refineries, ports, and neighborhood truck traffic. The ideas proposed by South Coast AQMD staff and the feedback received from the CSC and members of the public laid the foundation for the air monitoring approach and strategy that will be described in more details in the following sections of this document.

At the time of this writing, a fifth CSC meeting in WCWLB is planned for April 11, 2019 in Wilmington. Also, additional CSC meeting will be conducted monthly for the remainder of 2019.

## Existing Monitoring Programs in the WCWLB Community

South Coast AQMD staff has been conducting air quality measurement activities in the WCWLB community for several years. Below is information regarding existing and upcoming rules, projects, and

programs at South Coast AQMD that will focus on air monitoring from a variety of sources within the WCWLB area. The monitoring data that will be collected from these other initiatives will be used to complement the data gathered during AB 617, and will greatly enhance our understanding of the impact industrial emissions have on air quality in this community. The CAMP will be developed based on sound scientific principles and successful practices that build from knowledge gained through the existing and upcoming community air monitoring programs described below. This approach allows for the ability to accommodate the diversity of air monitoring objectives in each community.

## Regulatory Monitoring Stations

The South Coast AQMD operates more than 40 permanent air monitoring stations in the Basin, two of which are within the WCWLB community boundary. These are the Long Beach (Hudson) and the Long Beach Route 710 Near Road monitoring sites (Figure 2). The latter is adjacent to one of the most heavily traveled roadways in Southern California with a high number and percentage of heavy duty diesel truck traffic. In addition, South Coast AQMD's Long Beach (Signal Hill) permanent station is located right outside the WCWLB community boundary. Air monitoring at these three permanent monitoring stations focuses mainly on criteria pollutants to ensure attainment with air quality standards set by the U.S. EPA, and does not provides sufficient information on air toxics (see Table 2 for details).

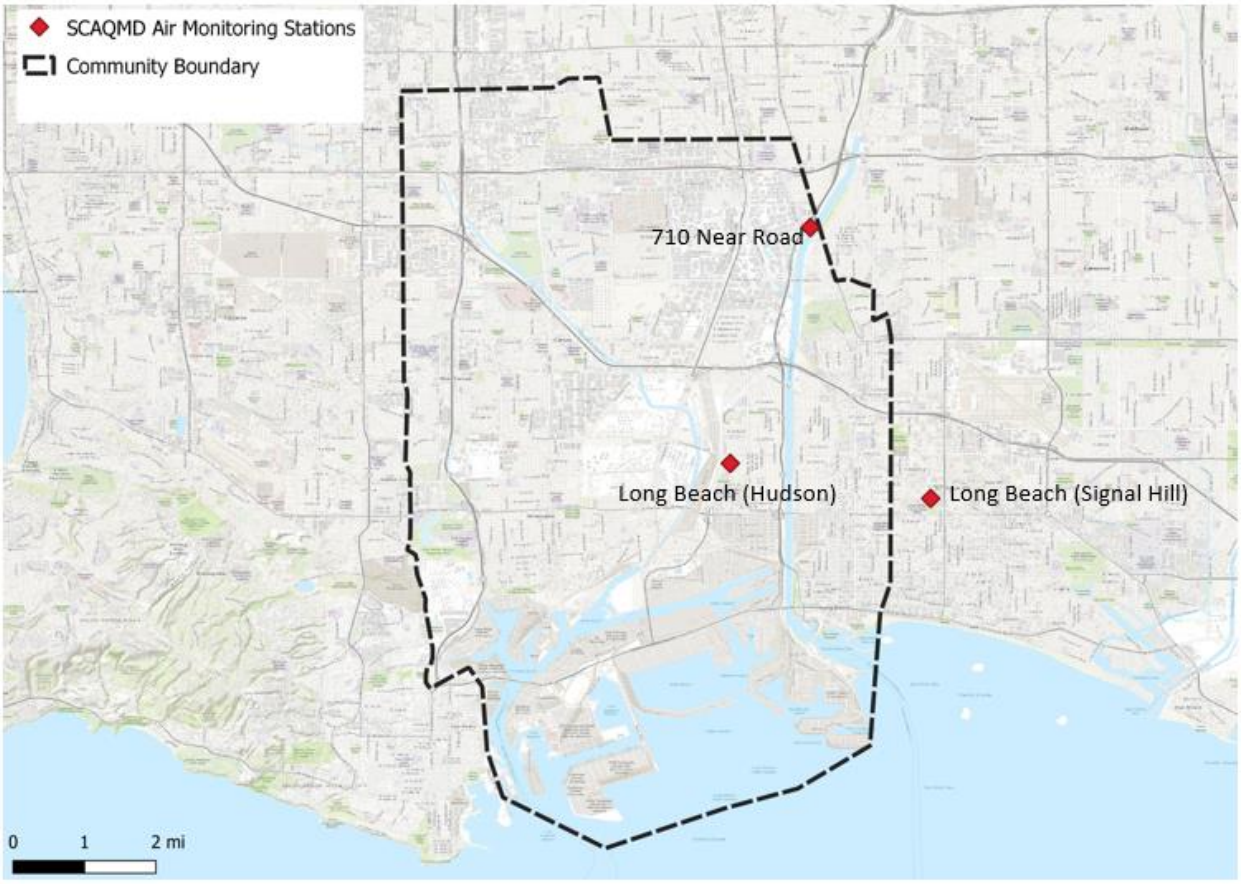


*Figure 2 - Regulatory Monitoring Stations*

*Table 2 - Description of Monitoring Stations in WCWLB Area*

| Location | Site Address | Pollutants Monitored | Start Date |
|---|---|---|---|
| Long Beach (Hudson) | 2425 Webster St.<br>Long Beach, CA 90810 | CO, $NO_2$, $SO_2$, $O_3$, PM10 | Jan-2010 |
| Long Beach (Signal Hill) | 1710 East 20th Street<br>Signal Hill 90755 | PM2.5 | Jan-2018 |
| Long Beach Route 710 Near Road | 5895 Long Beach Blvd.<br>Long Beach CA 90805 | $NO_2$, PM2.5, Continuous PM2.5, Black Carbon | Jan-2015 |

## Real-Time Continuous Facility Stack Monitoring

In addition to regulatory ambient monitoring, federal, state and South Coast AQMD rules require some of the facilities in WCWLB to measure emissions from on-site sources and assess their compliance with air quality standards. By law, these facilities must have monitoring equipment, subject to strict operational requirements, on specific pieces of equipment or smokestacks in order to document continuous compliance as well as exceedances of standards. Facilities are required to self-report violations of emissions standards and problems with monitor operation to the South Coast AQMD. These monitors only provide emission data from the largest portions of individual facilities, and do not identify fugitive emissions from other potential sources, such as wells, tanks and compressors at oil and gas production sites.

## Multiple Air Toxics Exposure Study (MATES)[3]

The MATES program is an Environmental Justice initiative that provides information on air toxics monitoring at about ten sites throughout the Basin for a one to two year period. Over 30 air pollutants are measured at each fixed station, including gaseous and particulate air toxics. These measurements allow tracking the ambient concentration of air toxics over time. MATES also includes the development of an air toxics emissions inventory, and of modeling to characterize health risks from long-term regional air toxics levels in residential and commercial areas. The most recently completed MATES study (MATES IV) was conducted from 2012-2013.

MATES V began in April 2018 and will continue until May 2019 or longer, as some of the measurement activities conducted within the boundaries of AB 617 communities will provide useful air toxic information for this program. One of the MATES V fixed monitoring stations (Long Beach (Hudson)) is within the WCWLB community boundary while another MATES V monitoring station (Long Beach (Signal Hill)) is right outside of the boundary. Continuation of these measurements will provide valuable data for the overall assessment of baseline conditions to evaluate regional air toxics contribution in WCWLB. It will also allow assessment of the effectiveness of various CERP measures and provide information on air toxics trends over the course of the AB 617 Program. More information on MATES can be found at: http://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies.

As part of this study, South Coast AQMD staff is also deploying advanced state-of-the-art air monitoring technologies and near real-time data to better understand the potential impact of refinery emissions on

[3] Multiple Air Toxics Exposure Study (MATES): http://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies

Wilmington and Carson communities. The motivation behind the enhanced monitoring efforts is to better characterize air toxics levels in highly impacted areas, to provide higher resolution air quality data, and to better understand emissions from petroleum refineries and warehouses.

## MATES V - Aerial Air Toxic Measurements

As part of MATES V, the South Coast AQMD has sponsored a project with the Aerospace Corporation (Aerospace) to conduct aerial measurements using airborne LongWave-InfraRed (LWIR) hyperspectral imaging technology. This technology (developed by Aerospace) will be used during aircraft flights for air toxics measurements over a large area that will cover the entire WCWLB community. This represents a unique opportunity to characterize many potential (known and unknown) sources of VOCs (including refineries and other industrial facilities) that are otherwise very difficult and time consuming to measure. This instrumentation is capable of detecting benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds, formaldehyde and other air toxics in addition to ammonia, sulfur dioxide ($SO_2$), and NOx. One of the main advantages of this technology is that it can identify potential emissions sources and pollution hotspots that are otherwise difficult to discover using ground-based measurements. Aerospace has been conducting flight-based measurements in the Basin for more than seven years, including areas near major petroleum refineries within the WCWLB Community. As part of this contract with the South Coast AQMD, Aerospace will conduct flight-based measurements in the Wilmington, Carson, West Long Beach and other communities of the Basin to better characterize the distribution of air toxic emissions from major refineries and other sources of air toxics.

In addition, Aerospace will work with South Coast AQMD staff to conduct a re-analysis of historical data from flight-based measurements conducted over the past seven years. This may allow the identification of toxic hotspots over the Basin and track variability over time. The data obtained from these flight-based measurements will enhance our understanding of the location and time variability of air toxic emissions, and the analysis and interpretation of more conventional and traditional air toxics monitoring and emissions estimates. These flight measurements will also assist in the selection of locations for enhanced ground-based monitoring, using both fixed and mobile measurements.

## MATES V - Sensor Network Deployment Wilmington/Carson

Another project that South Coast AQMD coordinates as part of the advanced air monitoring portion of MATES V is the deployment of a high-density network of sensors in the Carson and Wilmington area to measure air pollutants and meteorological conditions in real time. A San Francisco-based company (Aclima Inc.[4]) that designs and deploys environmental sensor networks will be the lead for this project. The deployment includes three sets of sensors: 1) "ZooBox"; 2) "S-Pod"; and 3) weather stations. The "ZooBox" sensor is a real-time cellular-connected device for measuring combustion-related air pollutants including PM2.5, PM10, $NO_X$, CO and $CO_2$, barometric pressure, temperature and relative humidity. The "S-Pod" is a sensor for measuring VOCs, and has been developed for measuring leaks and fugitive emissions near oil and gas facilities. A total of 36 ZooBox sensors and 36 S-Pod sensors are being deployed throughout the Carson and Wilmington area, mainly at schools, parks and other public places. The weather stations measure wind speed and direction to better understand small scale weather patterns in the local area and identify the potential sources of elevated levels of air pollutants. All of these sensors are connected to a cloud platform, which is designed to aggregate, unify, and analyze the

[4] Aclima Inc. https://aclima.io/

data. Aclima will also implement a user interface specific to the community where users can explore the data from all the sensors integrated in the deployment.

## Community Scale Project

In the fall of 2015, South Coast AQMD staff worked with FluxSense Inc. to conduct three optical remote sensing (ORS) projects to characterize and quantify emissions from refineries and refinery related activities, point sources such as oil wells and gas stations, and marine vessels and the ports. This was part of the South Coast AQMD's fenceline monitoring program that began in 2013[5].

Starting in the fall of 2016, South Coast AQMD staff and FluxSense Inc. have been conducting periodic mobile monitoring surveys designed to quantify emissions of VOCs, air toxics (formaldehyde and BTEX), $NO_2$, and $SO_2$ from refineries in WCWLB and other areas of the Basin. Under this project, FluxSense is scheduled to continue with quarterly surveys through the end of 2019. Refinery emissions data collected during different seasons and over multiple years will allow better understanding of seasonal variations in refinery emissions, and to conduct a multi-year comparison between the measured refinery emissions and the corresponding emissions reported in the inventories. Multi-year measurement record will assess if the discrepancies between the measured and reported refinery emissions of VOCs and certain air toxics identified during the 2015 South Coast AQMD ORS study still persist. In addition to emission quantification, extensive mobile community air monitoring has been also conducted by FluxSense on a quarterly basis. The community air monitoring strategy employed by FluxSense involves concentration mapping around the refinery fenceline (or any other known industrial source). If elevated levels of air pollutants are detected, then the plume is followed into downwind communities. These community monitoring surveys are conducted multiple times, during different times of day, and different meteorological conditions.

Mobile ORS surveys conducted by FluxSense for the Community Scale Project informed and will continue to support the AB 617 activities in the following important ways:

- Inform the development of community monitoring strategies by drawing from the experience gained during the mobile air quarterly surveys;
- Help to identify air-pollution "hot spots" in WCWLB and other communities;
- Help to identify, characterize and quantify emission sources;
- Assist with development of CERP by prioritizing emission reduction strategies by identifying and quantifying large sources of VOCs;
- Provide air quality and emissions information to track the effectiveness of emission reduction measures by conducting before- and after- monitoring.

[5] Fenceline Monitoring: http://www.aqmd.gov/fenceline-monitoring

## Rule 1180 – Refinery Fenceline and Community Air Monitoring

In recent years, community concerns over emissions from refineries, both from routine facility operations and potential releases due to upset conditions or emergency situations, and the potential for community exposure to air contaminants have increased. Additionally, South Coast AQMD's technology demonstration studies conducted in the last five years, suggested that fugitive emissions of VOCs and other air toxics from refineries may be greater than estimated by emission inventories. As a result, in December 2017 South Coast AQMD Governing Board adopted Rule 1180[1], which applies to all major petroleum refineries in the Basin (those with a maximum capacity of 40,000 barrels of crude oil per day or more). The rule requires petroleum refineries to design, install and operate continuous, fenceline air monitoring systems to monitor a comprehensive list of criteria pollutants, VOCs and other toxic air contaminants in real-time. Rule 1180 also requires the refineries to pay for comprehensive community air monitoring[1]. South Coast AQMD staff is developing the plan to design, install and operate air monitoring systems that provide air quality information to the public about levels of various air pollutants (including air toxics) in communities near refineries. The WCWLB community includes five major refineries within its boundaries:

- Tesoro Los Angeles Refinery, Carson, CA;
- Tesoro Los Angeles Refinery, Wilmington, CA;
- Phillips 66 Refinery, Carson, CA;
- Phillips 66 Refinery, Wilmington, CA;
- Valero Wilmington Refinery, Wilmington, CA.

Table 3 outlines the pollutants and technologies that will be utilized for fenceline air monitoring at each refinery fenceline. The monitoring will be conducted continuously, with a high time resolution of five minutes, and will be presented to the public in near real-time via a dedicated website. With the exception of hydrogen sulfite ($H_2S$) and black carbon (BC), open-path technologies, such as Long Path Differential Optical Absorption Spectroscopy (LP-DOAS) and Open Path Fourier Transform Infrared Spectroscopy (OP-FTIR) will be implemented for fenceline monitoring, and will provide near-full fenceline coverage at all refineries. A similar list of compounds will be monitored at 10 community monitoring stations near the refineries, utilizing continuous, real-time point in-situ instrumentation whenever possible. Community and fenceline air monitoring real- or near real-time data will be made available online to the South Coast AQMD, refineries and the public.

*Table 3 - Pollutants and Technologies for Fenceline Air Monitoring as Part of Rule 1180*

| Air Pollutants | Fenceline Air Monitoring Instruments |
|---|---|
| Criteria Air Pollutants | |
| Sulfur Dioxide | LP-DOAS |
| Nitrogen Oxides | LP-DOAS or OP-FTIR |
| Volatile Organic Compounds | |
| Total VOCs (Non-Methane Hydrocarbons) | OP-FTIR |
| Formaldehyde | LP-DOAS or OP-FTIR |
| Acetaldehyde | OP-FTR |
| Acrolein | OP-FTIR |
| 1,3-Butadiene | OP-FTIR |
| Styrene | OP-FTIR |
| BTEX Compounds (Benzene, Toluene, Ethylbenzene, Xylenes) | LP-DOAS |
| Other Compounds | |
| Hydrogen Sulfide | Point Monitor |
| Ammonia | OP-FTIR |
| Black Carbon | Aethalometer |
| Hydrogen Fluoride+ | OP-FTIR |
| Hydrogen Cyanide | OP-FTIR |

*+ If the facility uses hydrogen fluoride.*

The continuous fenceline monitoring data will alert the refinery operators of elevated levels of pollutants at the refinery fenceline, allowing faster and more efficient identification and repair of unplanned / unwanted emissions (e.g. leaks). The community monitoring will provide better understanding of the pollution experienced by the communities adjacent to the refineries.

The Rule 1180 community and fenceline air monitoring network will help to achieve the goals and objectives of AB 617 in a number of important ways. Specifically, Rule 1180 monitoring activities will help:

- Better characterize refinery emissions by providing a continuous record of concentrations of air pollutants at the refinery fencelines;
- Better characterize community exposure by collecting a continuous record of air quality inside the communities;
- Identify potential non-refinery sources that also affect air quality in communities;
- Evaluate all fence line triggers at refineries and take the appropriate enforcement action when warranted based on rule requirements and permit conditions; and
- Provide air quality information to track progress/effectiveness of emission reduction measures.

Health and Safety Code section 42705.6 (known as AB 1647) requires community and fenceline monitoring to commence in January 2020 and Rule 1180 requires to commence fenceline monitoring one year from South Coast AQMD's approval of fenceline air monitoring plans.

# Air Monitoring Equipment and Methods

## Field Equipment

New technological advances are transforming and revolutionizing air quality measurements. South Coast AQMD staff is actively leading research to further develop, evaluate, and implement the use of a wide array of new air quality monitoring approaches and technologies. South Coast AQMD staff has been working with communities, putting low-cost, portable air sensors into the hands of community members to investigate air quality in their neighborhoods and communities. New air measurement methods such as optical remote sensing are making it easier to track air pollution leaks from industrial facilities. Leaks and other fugitive emissions can be significant sources of pollution impacting nearby communities and can come from industry, refineries, oil production and drilling, and natural gas pipelines. South Coast AQMD staff has also been utilizing new and improved ways of fenceline monitoring using mobile platforms with high time resolution air pollution instrumentation to quantify source emissions and local scale air pollution trends near roadways, rail yards, ports, refineries, oil and gas production, and other large area sources.

South Coast AQMD staff will use a combination of existing and new air monitoring equipment to implement the air monitoring portion of AB 617 for developing community-driven and measurement-based emission and exposure reduction strategies. This includes EPA approved methods for measuring particle and gaseous pollutants (i.e. Federal Reference Methods and Federal Equivalent Methods; or FRM and FEM, respectively), air monitoring instruments and equipment used for EPA funded national programs for air toxic measurements (i.e. National Air Toxics Trends Stations (NATTS)[6] and Photochemical Assessment Monitoring Stations (PAMS)[7], or other appropriate technology if FRM/FEM equipment for measuring a particular pollutant (or set of pollutants) do not exist (e.g. optical remote sensing and other state-of-the-art instruments and methods). In essence, appropriate technology for the intended purpose will be used to monitor the pollutants of interest in WCWLB and other AB 617 communities. Below is an in depth description of the main air monitoring equipment that will be used by South Coast AQMD staff, along with a few considerations regarding the use and application of this technology. A complete list of all available resources for field monitoring can be found in Appendix A.

## Mobile Platforms

Mobile measurements can be conducted using real- or near-real-time instruments to allow for large-scale community air pollution mapping at a fraction of the cost of conventional approaches and at higher spatial and temporal resolution. This will allow community members and policy makers to better understand local exposure levels, identify potential sources of emissions and track changes over time, demonstrating effectiveness of emission and exposure reduction programs.

The WCWLB community includes large and diverse industrial areas with a multitude of emission sources (e.g. tank farms, truck loading depots, refineries, ports, etc.). Areas that have such clustering of diverse sources are difficult to study and characterize using conventional air monitoring approaches (e.g. fixed site and fenceline measurements). Mobile monitoring and high resolution mapping will allow for the identification of areas of significant air pollution variability, and will enhance the fixed site measurements.

[6] National Air Toxics Trends Stations - https://www3.epa.gov/ttnamti1/natts.html
[7] Photochemical Assessment Monitoring Stations - https://www3.epa.gov/ttn/amtic/pamsmain.html

The South Coast AQMD currently has three mobile platforms, each equipped with different instrumentation for the measurement of particulate and gaseous pollutants including air toxics. Below is a brief description of each mobile platform and its capabilities:

**Mobile Platform #1**: This is equipped with FRM and FEM and research-grade instruments to measure the mass and number concentrations of particulate matter (PM) of various sizes, BC, CO, $NO_2$, $O_3$, and methane (Table 4). The time resolution of these air monitoring instruments range between 1 and 60 seconds. This mobile platform is a powerful tool for identifying areas most impacted by diesel PM emissions. It can also be used to identify diesel PM hotspots, estimate community exposure, estimate the exposure impact of transportation corridors and idling spots, and to track progress of targeted emission reduction strategies.

This mobile platform is also equipped with an anemometer and a Global Positioning System (GPS) to determine wind speed and direction and to map vehicle location, speed and bearing during air quality measurements. Real-time data is logged and displayed on on-board monitors, allowing staff to rapidly detect potential emission sources and follow plumes of interest. It should be noted that although this platform is capable of detecting the ambient concentration of various air pollutants in real- or near-real time, it takes a few days to validate and process the collected information and visualize it for public consumption. A few pictures of this platform and the instruments configuration/set-up are shown in Figure 3 below.

*Figure 3 - Picture of Mobile Platform #1*

*Table 4 - Air Quality Monitors and Measured Pollutants in Mobile Platform #1*

| Monitor | Measured Pollutant |
|---|---|
| **Teledyne (T640)** | $PM_{10}$ & $PM_{2.5}$ Mass |
| **GRIMM (EDM 164)** | $PM_{10}$, $PM_{2.5}$, & $PM_{1.0}$ Mass and Number |
| **Teledyne (T300)** | CO |
| **Teledyne (T500U)** | $NO_2$ |
| **Teledyne (430)** | $O_3$ |
| **Aerosol Devices Inc. (MAGIC CPC)** | Particle Number |
| **Droplet Measurement Technologies (Photoacoustic Extinctiometer (PAX))** | Black Carbon |

**Mobile Platform #2**: This platform is equipped with multiple advanced remote optical sensing (ORS) monitors that are capable of measuring a wide range of gaseous pollutants including air toxics (e.g. methane, non-methane VOCs, $NO_2$, $SO_2$, $NH_3$, benzene, toluene, ethylbenzene and xylenes; see Table 5) with time resolutions ranging between 1 and 30 seconds. Modern ORS techniques offer unique capabilities for monitoring trace gas emissions from point and area sources in near-real time. They are especially valuable for identifying leaks from fugitive emission sources, which are often extremely challenging to spot and/or quantify. This mobile platform is also equipped with a GPS for real-time recording of the position of the vehicle and onboard monitors for real-time data analysis and visualization. A Light Detection and Ranging (LIDAR; which provides vertical wind profiles) instrument for wind profile measurements is often deployed in conjunction with this vehicle for emission rate measurements of VOCs from refineries and other industrial facilities. This state-of-the-art mobile laboratory will be utilized for accurate characterization of facility-wide emissions from industrial sources of VOC emissions on a real or near-real time basis, fenceline monitoring, leak detection and follow up, near-real-time concentration mapping, and estimation of community exposure to air toxics. Although this platform is capable of detecting the ambient concentration of various air pollutants in real- or near-real time, it takes a few days to validate and process the collected information and visualize it for the public. Pictures of this platform and the instruments configuration/set-up are shown in Figure 4.

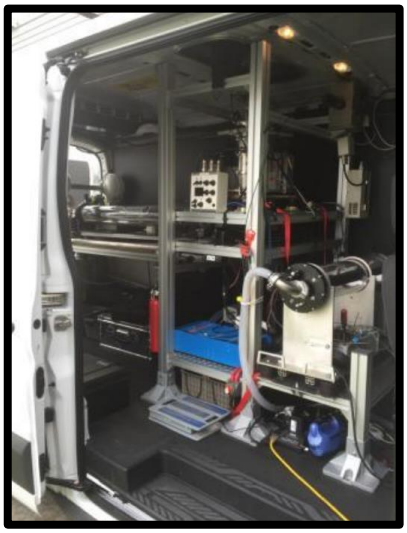

*Figure 4 - Picture of Mobile Platform #2*

*Table 5 - Air Quality Monitors and Measured Pollutants Used in Mobile Platform #2*

| Monitor | Measured Pollutant |
|---|---|
| **Solar Occultation Flux (SOF)** | Total Alkane, Carbon-number, Alkenes, $NH_3$ |
| **Sky Differential Optical Absorption Spectroscopy (SkyDOAS)** | $NO_2$, $SO_2$, HCHO |
| **Mobile Extractive Fourier Transform InfraRed (MeFTIR)** | Alkane, $CH_4$, $C_2H_4$, $C_3H_6$, $C_4H_8$, $NH_3$, CO,$CO_2$, $N_2O$ |
| **Mobile White Cell Differential Optical Absorption Spectroscopy (MWDOAS)** | Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) |

**Mobile Platform #3**: This platform is equipped with a state-of-the-art Proton Transfer Reaction – Mass Spectrometer (PTR-MS) capable of simultaneous real-time monitoring of hundreds of VOCs such as acetone, acetaldehyde, methanol, ethanol, benzene, xylenes and many others, including some inorganic compounds, present in ambient air. This is a fast response instrument (the time resolution spans from millisecond to 1-min) which has high sensitivity to low concentration of a wide range of VOCs (limit of detection (LOD) < 1 pptv). The high sensitivity of this mobile platform will allow the South Coast AQMD to respond to odor complaints, detect leaks or other potential sources of emissions (e.g. ports and ship emissions). Similar to the other two mobile platforms, real-time wind and position data will be measured and onboard computers will be used for real-time data analyses and visualization. Although this platform is capable of detecting the ambient concentration of various air pollutants in real- or near-real time, it takes a few days to validate and process the collected information and present the data visually.

## Monitoring Trailers

Fixed air monitoring trailers will be placed at strategic locations to fully characterize emissions and community's exposure (e.g. downwind of an identified air pollution source) to satisfy community specific air monitoring objectives. All fixed monitoring trailers available to the South Coast AQMD will be equipped with EPA approved instruments (i.e. FRM and/or FEM) and, if not commercially available, with state-of-the-at technology that is appropriate to measure the pollutant(s) of interest and for the intended purpose. They will be also equipped with wind measurement systems to better characterize and potentially locate the source(s) of the measured air pollutants. Table 6 summarizes the capabilities of the fixed monitoring trailers available for AB 617 deployment. It should be noted that these resources will be used to satisfy the needs of all present and future AB 617 community, and availability will depend on the specific air monitoring needs and objectives at each community, which is to be determined after consulting with the CSCs. The five monitoring trailers available to the South Coast AQMD will be outfitted with air monitoring instrumentation to address the specific air quality concerns of AB 617 communities. Trailers 1 and 2 have tentatively been assigned to the WCWLB community and their instrument configuration (as proposed in Table 6) seems adequate to fit the specific air monitoring needs of this community. The final instrument configuration for each trailer will be determined after consultation with the CSC.

*Table 6 - Available Fixed Monitoring Trailers for Community Monitoring in All AB 617 Communities*

| Trailer | Make (Model) | Measured Pollutant | Measurement Type |
|---|---|---|---|
| **Trailer 1** | Magee (AE33) | BC | Continuous |
| | Teledyne/TSI CPC (model 651) | Particle Number | Continuous |
| | Teledyne (T200) | NOx | Continuous |
| | Teledyne (T640) | $PM_{10}$ & $PM_{2.5}$ Mass | Continuous |
| | Picarro (G2204) | $H_2S$ | Continuous |
| | Teledyne (T300) | CO | Continuous |
| **Trailer 2** | Picarro (G2204) | CH4 and $H_2S$ | Continuous |
| | Mocon (SERIES 9000 MNME Analyzer) | Total Hydrocarbons, $CH_4$, NMHC | Continuous |
| | Tricorn Tech (MiTAP P310) | VOCs | Continuous |
| | Xonteck (901 Canister Samplers) | VOCs | Time Integrated |
| | BGI (Omni) | Speciated PM | Time Integrated |
| **Trailer 3** | Picarro (G2204) | $CH_4$ and $H_2S$ | Continuous |
| | Mocon (SERIES 9000 MNME Analyzer) | Total Hydrocarbons, $CH_4$, NMHC | Continuous |
| | Tricorn Tech (MiTAP P310) | VOCs | Continuous |
| | Xonteck (901 Canister Samplers) | VOCs | Continuous |
| | BGI (Omni) | Speciated PM | Time Integrated |
| **Trailer 4** | Magee (AE33) | BC | Continuous |
| | Teledyne/TSI CPC (Model 651) | Particle number | Continuous |
| | Teledyne (T200) | NOx | Continuous |
| | Teledyne (T640) | $PM_{10}$ & $PM_{2.5}$ Mass | Continuous |
| | Picarro (G2204) | $H_2S$ | Continuous |
| | Teledyne (T300) | CO | Continuous |
| **Trailer 5** | Magee (AE33) | BC | Continuous |
| | Teledyne/TSI CPC (Model 651) | Particle Number | Continuous |
| | Teledyne (T200) | NOx | Continuous |
| | Teledyne (T640) | $PM_{10}$ & $PM_{2.5}$ Mass | Continuous |
| | Cooper (Xact 625) | Particulate Metals | Continuous |
| | Teledyne (T300) | CO | Continuous |
| | Picarro (G2204) | $H_2S$ | Continuous |

## Air Quality Sensors

This technology is capable of providing real- or near-real time air pollution information with spatial and temporal resolution that is often greater than what can be achieved by other, more established monitoring technologies. Although sensors offer great potential, their accuracy and reliability varies widely and are generally not on par with those of FRM and FEM instruments approved by the US EPA. Despite these limitations sensors can be used effectively for community and fenceline monitoring provided their performance has been well characterized prior to their use, and is appropriate for their

intended application. For the purposes of this CAMP, sensors will be primarily used to complement and augment the capabilities of our fixed monitoring locations. Where there is community interest to learn more about sensors, South Coast AQMD staff can conduct training workshops to talk about the appropriate use and operation of this technology and how to interpret sensor data. The South Coast AQMD will provide sensors that community members can use to monitor air quality conditions in the WCWLB area.

South Coast AQMD staff is working with Aclima to install and operate a dense network of sensors in this community ahead of AB 617 air monitoring as part of MATES V. Several sensor solutions are now available for community monitoring applications that are easy to use and integrate within a network, and the existing MATES V sensor network could be augmented. The goal of this project is to increase community engagement and improve usability and utility of sensor networks and data interface to suit the community needs and create a powerful tool to address community's air quality concerns and to support the effective implementation of the CERP by tracking its progress.

Additional information on commercially available sensor technology can be found on South Coast AQMD's Air Quality Sensor Performance Evaluation Center (AQ-SPEC) website[8]. AQ-SPEC is the most comprehensive sensor evaluation program in the Unites States and its main goal is to provide citizen scientists and other sensor users with unbiased information on sensor performance based on rigorous field and laboratory testing. As part of the AB 617 related activities AQ-SPEC staff is proposing to build a second environmental chamber to evaluate the performance of individual commercially available sensors for their appropriateness for community monitoring applications.

## Additional Field Monitoring Capabilities

### Particle Speciation and Metals

Aerodyne Research, Inc. will conduct a comprehensive study to locate emission sources of PM and PM species, and air toxic metals in several areas of the Basin using a suite of near-real-time, next-generation analytical equipment on board of a mobile platform (the Aerodyne Mobile Laboratory; or AML). As part of this project, Aerodyne will survey different neighborhoods within the WCWLB community to evaluate potential exposure levels.

### Port and Ship Emissions

Aerodyne will also deploy fixed multiple air monitoring stations (each including a PTR-MS and other equipment) to measure hydrocarbons and sulfur for the purpose of identifying the cause(s) of the odor complaints that are often received by the South Coast AQMD in the coastal areas of Los Angeles during the summer months. A review of past complaint reports revealed two distinctive odor characteristics, one associated with sulfur, ranging from rotten egg to natural gas (odorant) smell, the other associated with a strong petroleum odor. Sources that are likely to be responsible for these odor complaints include ship emissions, off-shore platforms, oil production sites and other port related activities. These have been confirmed by investigation conducted by South Coast AQMD. The deployment of sensitive real-time instrument capable of detecting both sulfur and hydrocarbons will the help identify the specific source(s) of these odor complaints.

[8] Air Quality Sensor Performance Evaluation Center (AQ-SPEC) : http://www.aqmd.gov/aq-spec

### Truck Traffic and Other Motor-Vehicle Emissions

South Coast AQMD staff will work with Aclima to augment the sensor network with mobile mapping and measurements. These mobile measurements will provide insight into hyper-local air quality in the WCWLB community. Mapping will take place over a three month period, gathering data on $CO_2$, CO, NOx, $O_3$, PM, methane and ethane. Aclima will also test a total VOC sensing module during these mobile mapping activities. These efforts will enhance the value of the sensor network by providing a better understanding of the spatial variability in truck traffic emissions in WCWLB; enhancing the sensor network data quality through calibration between mobile and stationary sensors; and informing future mobile surveys and targeted measurements. This is an important addition that will show how well stationary sensor measurements represent the pollution observed at all geographical areas throughout the WCWLB community.

### Laboratory Analysis

In cases where time-integrated samples are collected (e.g. to identify and quantify the presence of hexavalent chromium (Cr6+), other heavy metals or VOCs), South Coast AQMD staff will employ sampling and laboratory methods that have been used for other established air monitoring programs. Since 1994, the South Coast AQMD has implemented the U.S. EPA PAMS program to gather data on ozone precursors. In 2008 the NATTS was also implemented. Some of the same sampling instruments used in the PAMS and NATTS programs are also used in MATES, which is designed to characterize long-term regional air toxics levels in residential and commercial areas.

AB 617 monitoring also utilizes some of the sampling instruments and techniques that are used in established monitoring programs (i.e. U.S. EPA) and, therefore, many of the procedures and protocols for the AB 617 monitoring are based on the South Coast AQMD Quality Management Plan for Environmental Measurement Programs[9] (January 2009) and Quality Assurance Project Plan (QAPP) for Special Monitoring. . For measurement methods not specified in these plans, the manufacturer's recommended operational and quality control procedures will be implemented. In all cases, the data quality for the measurements will be suitable for the intended purpose.

All time-integrated samples will be handled according to the laboratory practice for implementation of toxics analysis and particulate matter network programs. A more detailed description of these methods is provided in the Quality Assurance Project Plan (QAPP) document that is currently under development.

## Community Air Monitoring Approach

Selecting a sound air monitoring approach and appropriate methods and equipment is crucial to the success of this CAMP because the monitoring data that will be generated needs to support the continued development of the CERP, and support effective action. Considering the WCWLB community covers a vast geographical area characterized by a wide variety of air pollution sources, an approach that integrates the three air monitoring strategies described below seems appropriate for addressing the numerous air quality concerns identified by the CSC in an effective and comprehensive manner. The basic elements of this approach include mobile monitoring, fixed monitoring and low-cost sensors (Figure 5).

[9] Applied Science & Technology. (2009). Quality Management Plan for Environmental Measurement Programs. Diamond Bar, CA: South Coast Air Quality Management District.

## Mobile Monitoring

The South Coast AQMD has acquired mobile platforms that use advanced monitoring equipment to measure the ambient concentration of particle and gaseous pollutants in real- or near-real-time. The ability to measure highly resolved air pollution concentrations while driving makes these platforms ideal for surveying large areas in a relatively short period of time (hours to days), identify hot-spots of air pollution and sources that were previously unknown, providing valuable data for enforcement consideration, and inform emission reduction efforts. These platforms have been successfully used by the South Coast AQMD in the past to identify leaking tanks around refineries, characterize exposure in communities downwind of potential VOC sources and for other similar applications[6]. For the purpose of AB 617 implementation in the WCWLB community, mobile platforms will be used on a recurring basis to identify air pollution sources and track progress towards emission reduction as actions are taken to reduce known sources of air pollution of concern. The technical specifications of these platforms have been described earlier in this document. The QAPP will be included in future versions of this CAMP which outlines the procedures that will be taken to ensure that the mobile monitoring data that will be collected as part of this project is of the appropriate quality and meets the project requirements.

## Fixed Monitoring

Once extensive mobile monitoring has been conducted in WCWLB, South Coast AQMD staff will provide the CSC and the public with a summary of the measurement results and inform them on which specific area, or air pollution sources, have been identified as potential concerns for the community. Once the South Coast AQMD and the CSC agree on how to prioritize these specific air quality concerns, fixed air monitoring trailers (each equipped with the most appropriate technology for the intended purpose) will be placed at strategic locations (e.g. in an easily accessible and safe area downwind of an identified air pollution source) to satisfy community specific air monitoring objectives including: characterize (qualitatively and quantitatively) the emission sources, assess potential community exposure, support and further CERP development, and help tracking progress towards emission reduction. The length of time for which these fixed monitoring trailers will be deployed depends on the specific air monitoring objectives for the area of interest but could vary between several weeks and several months, or until a higher priority area have been identified within the WCWLB community. It should be noted that if well-known sources of air pollution are identified as high priorities for air monitoring by the CSC, the nearby location(s) will be surveyed to check the possibility of doing fixed monitoring without conducting preliminary mobile measurements prior. A QAPP will be included in future versions of this CAMP which outlines the procedures that will be taken to ensure that the fixed station data that will be collected as part of this project is of the appropriate quality and meets the project requirements.

## Sensor Monitoring

With recent advancements in sensor technology, low-cost devices for measuring particle and gaseous pollutants are now available for community monitoring. The accuracy, precision and overall performance of these devices is not comparable to that of more expensive air monitoring instruments such as those that will be used in the mobile platforms and fixed monitoring trailers described earlier. However, when appropriately deployed within a network, sensors are capable of providing valuable information regarding the spatial and temporal variability of the pollutant(s) of interest. Because of their limited capabilities, these sensors cannot be used in lieu of more sophisticated EPA approved air monitoring equipment. For the purpose of this CAMP, air quality sensors will mainly be used to supplement data from fixed monitoring stations, to characterize the spatial and temporal variability of

the pollutant(s) of interest, to educate the community members in the correct use and operation of this technology, and to engage them in the air monitoring process that will be developed and implemented in WCWLB. South Coast AQMD staff has extensive experience working with communities in Southern California and throughout the State in the development, operation and maintenance of sensor networks for air quality measurements. South Coast AQMD staff is currently working with some of the CSC members and community groups and will provide sensors and support to build a community-driven sensor network in WCWLB. For more information please visit the AQ-SPEC website[9]. A QAPP outlining the procedures that will be taken to ensure that the sensor data that will be collected as part of this project is of the highest quality and meets the project requirements is under development and will be included in future versions of this CAMP.

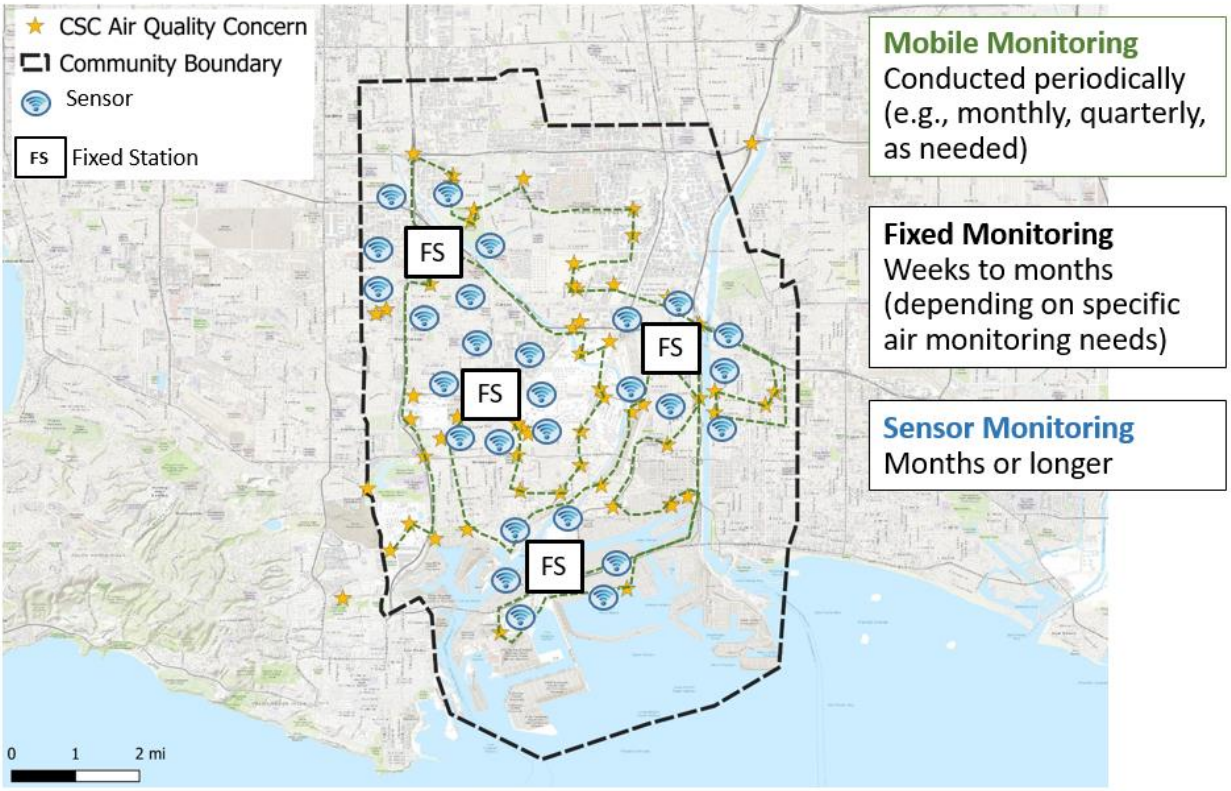


*Figure 5 - Overview of Monitoring Approach Proposed in this CAMP*

***NOTE: This is a conceptual diagram representing a hypothetical scenario. The actual route that will be followed by our mobile platforms (dotted line), and the exact number and locations of fixed monitoring stations and sensor networks that will be deployed in this community will be determined in consultation with the CSC.***

## Approach, Benefits and Limitations

Performing wide area surveys using mobile monitoring equipment will allow South Coast AQMD staff to locate and quantify potential emissions of air pollutants near priority areas identified in the WCWLB community. In instances where elevated levels of pollutants are detected, the plume will be mapped by

driving away from the source. Further source identification can be performed by detecting the pollution plume(s) and triangulating from the plumes back to the source using wind direction to guide the measurements. Real-time mobile concentration measurements can also be used to estimate emission rates from refineries and other industrial facilities[5]. While the mobile platforms are powerful tools for comprehensive source characterization and can survey a large area in a relatively short period of time, they can only provide a "snapshot" of the measured pollutants when the monitoring occurred. Therefore, mobile measurements generally do not capture daily variations in pollutant concentrations.

When emission sources are clearly identified and an initial assessment through mobile measurements is not needed, fixed monitoring will be deployed near the source(s) to commence monitoring without delays. Fixed monitoring allows for a more comprehensive characterization of air pollution trends over an extended period of time, but it only provides air quality information at the specific location. The use of both mobile and fixed monitoring will allow for these methods to effectively complement each other. In addition, the use of low cost sensors will significantly augment the capabilities of the fixed monitoring sites by expanding the spatial distribution of the air quality measurements. Given their low cost, these sensors are becoming an attractive means for governmental agencies, local environmental groups and individuals to evaluate air quality. Because this technology is low cost and quite novel, the data quality is often not comparable with US EPA-approved monitors and data must be interpreted with caution. Moreover, low cost sensors are limited in the number and types of air pollutants that can be measured reliably. Most of these devices are designed to measure criteria pollutants, although new sensors are being developed for measurements of total VOCs and BC. It should be noted that the deployment of sensor networks within the WCWLB community will only be considered if the pollutant(s) of interest can be measured using technology with an appropriate level of performance, as characterized by South Coast AQMD's AQ-SPEC[8] or equivalent program.

## Air Monitoring Prioritization Based on Community Input

The first step in implementing the proposed approach is to identify the areas within the WCWLB community that are most impacted by local air pollution sources and include the highest number of air quality concerns. In the first CSC meeting, the CSC members and members of the public identified a number of specific air quality concerns and their locations through subsequent meetings. Specifically, the list of concerns was refined and completed through CSC meetings #2 and #3. The resulting map including all of these concerns and a more detailed description for each concern is shown in Figure 1 and is also available online[10].

During CSC meeting #3, the CSC members and members of the public grouped the air quality concerns listed in Figure 6 into six different categories based on the relevance of their sources and high impact on the community. The following six categories were selected as high priority and will be the focus of the CAMP and CERP: Refineries, Ports, Truck Traffic, Oil Drilling/Production, Railroads, and Sensitive Receptors (ranked in this order). A more detailed description on each of these groups is available in Table 7.

[10] AB 617 Community Air Initiatives: http://www.aqmd.gov/nav/about/initiatives/environmental-justice/ab617-134/wilm

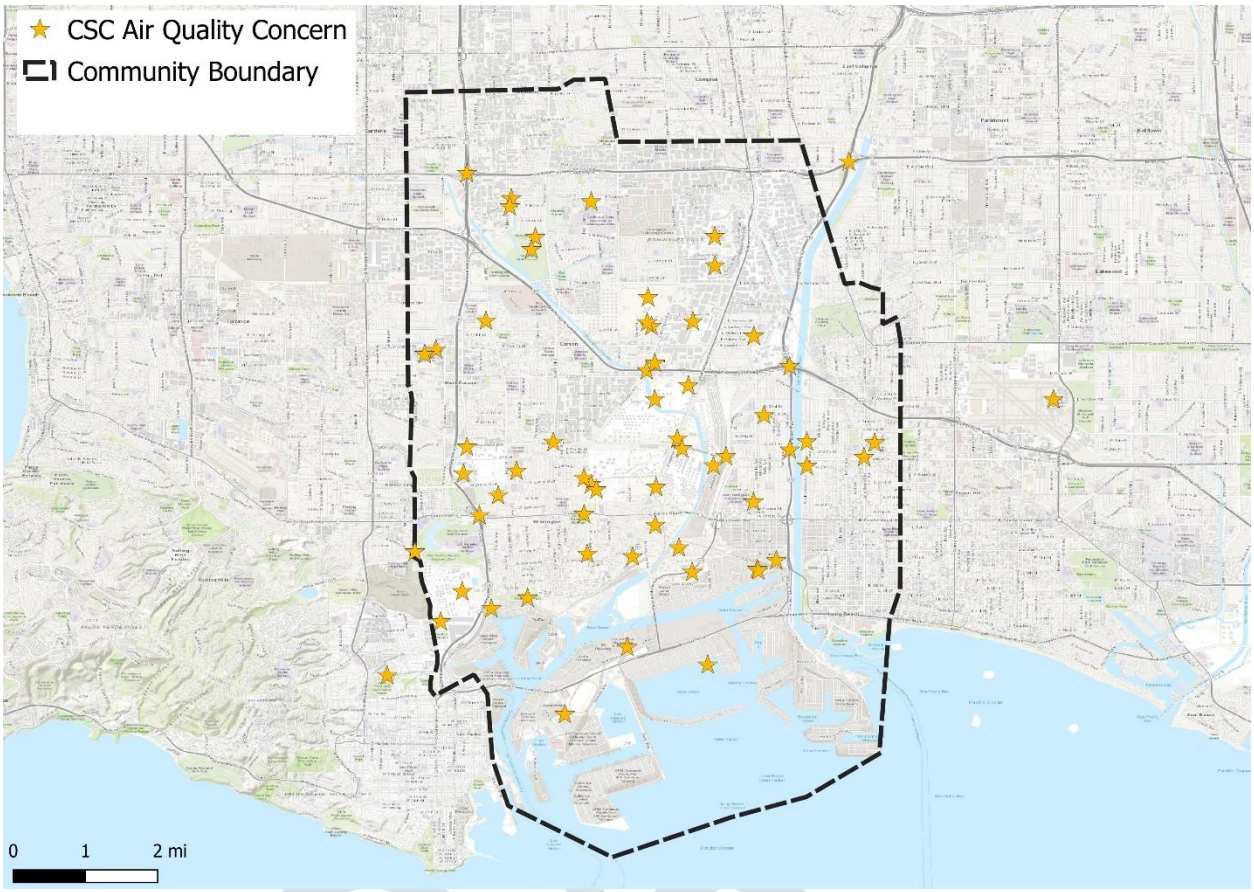


*Figure 6 - CSC Air Quality Concern Locations within the Boundary of the WCWLB Community*

*Table 7 - Major Community Concern Categories as Established by the CSS*

| General Air Quality Concern | Details of Concern |
|---|---|
| 1-Refineries | - Flaring and Public Notification<br>- Refinery Equipment<br>- Storage Tanks and Refinery Leaks<br>- Hydrogen Fluoride |
| 2-Ports | - Ships<br>- Terminals |
| 3-Trucks | |
| 4-Oil Drilling/Production | - Wells and Drilling<br>- Leaks/Odors |
| 5-Rail | - Railyards |
| 6-Schools/Hospitals/Parks/Community | - Exposure |

Initial monitoring priorities were based on the relative number of air quality concerns in each part of the community, identifying areas most impacted by each source category. Sections within the WCWLB area were defined and prioritized based on the relative density of air quality concerns and air pollution sources within each section. It should be noted that the air monitoring methods and instruments used to address many of the community concerns are similar. For example air pollutants emitted from refineries and oil drilling activities are likely to be similar in nature (e.g. mostly BTEX and other VOCs, $H_2S$ and other gaseous pollutants) and will be monitored using similar instruments and measurement methods. On the other hand, ports, trucks and rails are major sources of diesel PM which require a monitoring strategy to effectively evaluate their impacts on community exposure. A detailed analysis of these areas and discussions regarding expected air pollutants to be measured and what type of technologies will be deployed is provided in Appendix B. The results of this evaluation are summarized in Figure 7. The purpose of this monitoring prioritization is to identify the locations where appropriate monitoring should commence. Note that these areas have been determined only based on the available data and community feedback. The monitoring areas and priorities can change based on the information gathered during monitoring, input from the community, and/or newly available data from different organizations.

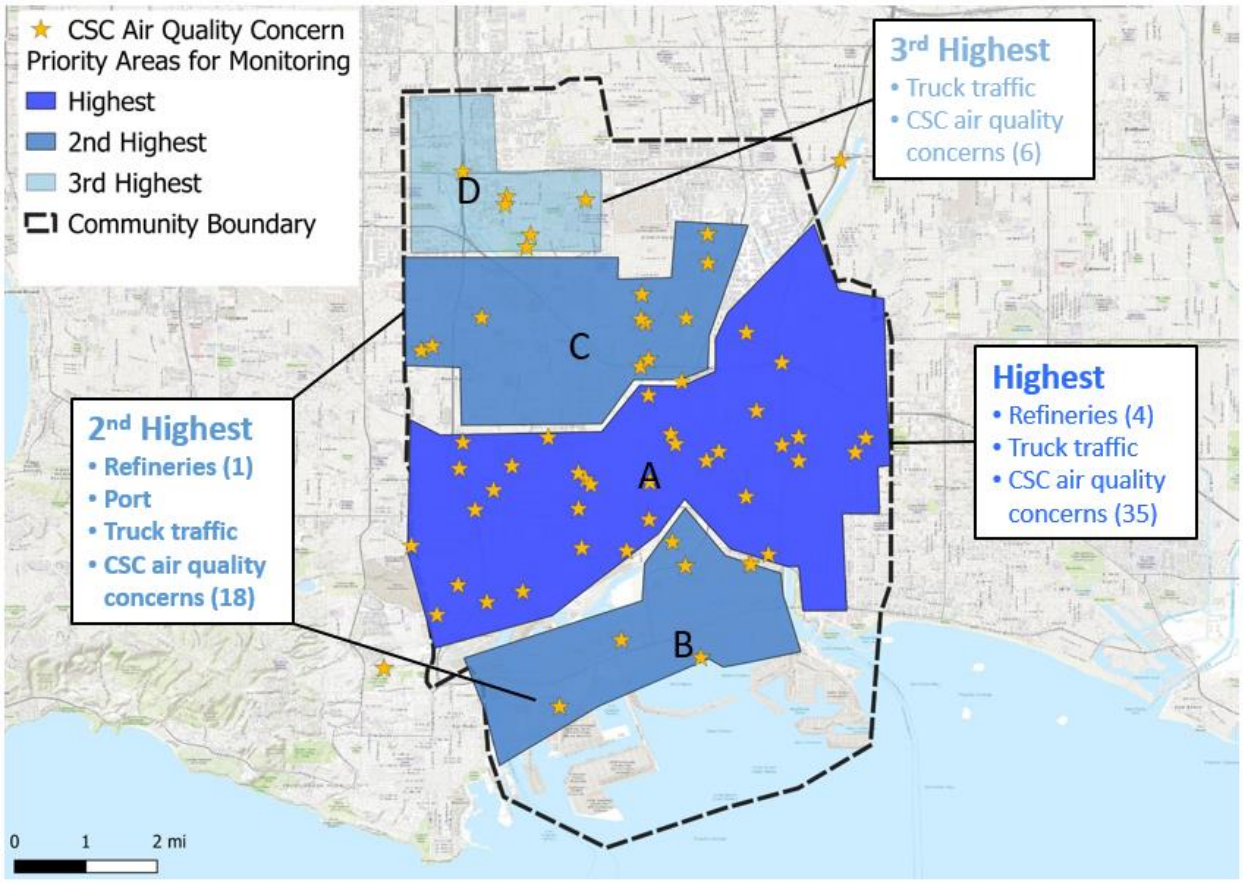


*Figure 7 - Proposed Monitoring Areas Prioritized Based on the Relative Density of Air Quality Concerns in the WCWLB Community*

Table 8 shows a summary of the monitoring prioritization process. Area A (highest priority) includes five of the concern categories identified by the CSC and community members. It also includes the highest density of refineries, rail, and oil production/drilling sources and 35 of 59 specific air quality concerns also identified by the CSC (illustrated by the yellow stars in Figure 7). Area B (second highest priority) also includes five air pollution categories. However, compared to Area A, it has a lower density of refinery sources, drilling activity near residential areas, and the land-use includes no residential area. Area C (also categorized as second highest priority) includes concerns from five categories, no refineries, a relatively low number of oil wells and railways, and the density of air pollution sources is lower than areas A and B. Areas B and C combined, include 18 specific air quality concerns. Area D (third highest priority) includes the lower number of source categories (mainly truck traffic) and 6 specific air quality concerns.

*Table 8 - Concerns in Each Proposed Monitoring Area (Letters Correspond to the Map in Figure 7)*

| Area | Refineries | Port | Truck Traffic | Oil Drilling | Rail | Sensitive Receptor | Land-use |
|---|---|---|---|---|---|---|---|
| A | X | | X | X | X | X | Residential/Industrial |
| B | X | X | X | X | X | | Industrial |
| C | X | | X | X | X | X | Residential/Industrial |
| D | | | X | | | X | Residential |

It should be noted that this monitoring prioritization exercise is mostly to organize the South Coast AQMD air monitoring activities and to provide necessary information in order to begin the measurements in the most impacted areas as quickly as possible. Because of the availability of multiple mobile platforms for air quality measurements, all community concerns identified in WCWLB will be surveyed within a relatively short period of time and in the order proposed here (e.g. from Area A to Area D).

## Data Validation, Analysis, Mapping, and Reporting

A comprehensive data platform for acquiring, validating, analyzing and mapping air measurement data is currently under development for AB 617. This platform will be capable of gathering data from the various air monitoring technologies that will be deployed in WCWLB and other AB 617 communities. These include both real-time and time-integrated data from EPA approved FRM and FEM monitors, research grade instruments (e.g. FTIR, UV-DOAS, and others), and air quality sensors. Data from selected fixed stations that are part of South Coast AQMD's air monitoring network[11] (e.g. Hudson and near road 710 sites) will also be added to the database to include information about local and regional air quality and provide a baseline for data analysis and interpretation.

The primary goal of the data platform is to share the monitoring data with the community to the extent feasible and as quickly as possible, so that it can be used to evaluate and adaptively manage the impacts of various emission reduction strategies in the community. Therefore, it is essential that the collected data must be made available and displayed online in a relevant, useful and understandable manner.

The data platform will have automated validation procedures to eliminate most of the invalid data from the air monitors so that preliminary measurement information can be provided to the community via dedicated website with minimal delay. Additional time will be needed for staff to fully validate the collected data and share this with the community in a downloadable format. The measurement data will go through rigorous review of calibration data, data processing calculations (such as conversion calculations of instrument signal to pollutant concentration), data consistency, field data sheets and logbooks, instrument performance checks, and equipment maintenance and calibration forms. All changes to the reported real-time data will be explained in subsequent documents and reports. Additional information to provide context to the collected air quality measurements will also be provided on our website. This includes an explanation of how background concentrations and/or contributions from other sources may affect the measured concentrations.

[11] 2018 Annual Air Quality Monitoring Network Plan: http://www.aqmd.gov/home/air-quality/clean-air-plans/monitoring-network-plan

The data platform being developed for AB 617 will also include data analysis and visualization tools which will be developed with input from the CSC and members of the public. This will allow users to create simple customized graphs and plots (e.g. time series of measured pollutants and wind data), display air quality information on a map, and generate other meaningful and interactive result summaries that can be shared with other users. In order to provide context to this complex data set for the public, the website will contain information regarding the species measured and the measurement techniques, discussion of levels of concern for each measured species, typical background levels, potential emissions sources that could contribute to measured concentrations, and definition of data QC flags. This will be written at a public-friendly level with clarity and thoroughness and with links provided to additional sources of information. In addition, the data website will 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. Some examples are shown in the Figure 8).

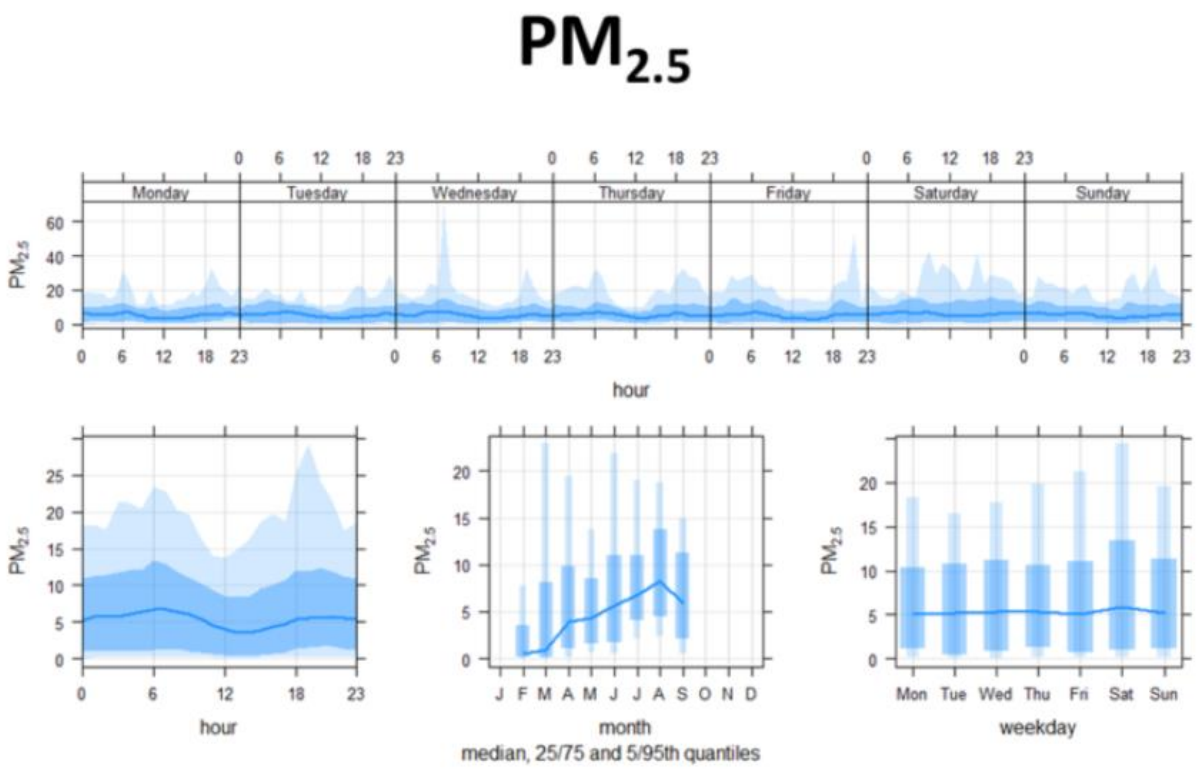


*Figure 8 - Example of a Time Series Plot to Show PM2.5 Trends by Day of Week, Hour of Day, and Month of Year*

## References


1- RULE 1180. Refinery Fenceline and Community Air Monitoring. Available at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1180.pdf
2- CARB (2018) *Community Air Protection Blueprint*. Available at: https://ww2.arb.ca.gov/our-work/programs/community-air-protection-program/community-air-protection-blueprint
3- Health Studies, Air Toxic Studies: http://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies
4- Aclima Inc. https://aclima.io/
5- Fenceline Monitoring: http://www.aqmd.gov/fenceline-monitoring
6- National Air Toxics Trends Stations - https://www3.epa.gov/ttnamti1/natts.html
7- Photochemical Assessment Monitoring Stations - https://www3.epa.gov/ttn/amtic/pamsmain.html
8- Air Quality Sensor Performance Evaluation Center (AQ-SPEC) : http://www.aqmd.gov/aq-spec
9- Applied Science & Technology. (2009). Quality Management Plan for Environmental Measurement Programs. Diamond Bar, CA: South Coast Air Quality Management District.
10- AB 617 Community Air Initiatives: http://www.aqmd.gov/nav/about/initiatives/environmental-justice/ab617-134
11- 2018 Annual Air Quality Monitoring Network Plan: http://www.aqmd.gov/home/air-quality/clean-air-plans/monitoring-network-plan

## Main Air Pollutants of Interest

As discussed in the previous sections, the CSC and the public members identified several emission sources as their highest priority air quality concerns. In order to fully characterize the emissions from these sources and quantify their impacts on the WCWLB community, it is important to measure the most relevant air pollutants. Below is a short description of the major particle and gaseous air contaminants that are emitted by the sources identified by the CSC and public members. Information from emission inventories and findings from previous air monitoring studies conducted in this community have also been taken in to account for the compilation of this list. This list is not exhaustive but will help better understand the specific monitoring methods, approaches and strategies outlined later in this CAMP.

### Particulate Matter (PM)

PM is comprised of a complex mixture of solid and/or liquid materials suspended in the air. Particles have different sizes, shapes, and chemical compositions. Based on their size, PM is generally categorized in three major categories:

- **PM10 (coarse PM)**: inhalable particles, with a diameter of 10 micrometers or smaller. These relatively large particles are generally mechanically generated by crushing or grinding operations;
- **PM2.5 (fine PM)**: fine inhalable particles, with a diameter of 2.5 micrometers or smaller. These particles are emitted from several sources such as traffic and industrial emissions or can be formed in the atmosphere through reaction of gaseous precursors;
- **Ultrafine particles (UFPs)**: very fine inhalable particles, with a diameter of 0.1 micrometers or smaller. UFPs are mostly emitted from fossil fuel combustion, particularly vehicular sources, or can be formed through photochemical reactions of gaseous precursors in the atmosphere. Unlike PM2.5 and PM10, which are measured by their mass concentration, UFPs are usually measured by the number of particles in a unit of air volume (i.e. number concentration).

### Black Carbon (BC)

BC is a product of incomplete combustion of fossil fuels, biofuels, and biomass, and is emitted directly into the atmosphere in the PM2.5 size range (mostly). BC is a major component of “soot” from biomass burning, and a good indicator of diesel PM from heavy duty trucks and locomotives. Although often associated with emissions from heavy-duty diesel engines, a portion of all combustion emissions contains BC.

### Nitrogen Oxides (NOx)

Both gasoline and diesel powered vehicles are the main sources of NOx emissions. However, substantial NOx emissions are also added into the atmosphere by stationary sources such as petroleum refineries and other industrial operations. NOx is a group of highly reactive gases that contribute to the formation of secondary particles, as well as tropospheric ozone. Scientific evidence links $NO_2$ exposures with adverse respiratory effects. $NO_2$ is one of the criteria pollutants, making it a compound that is routinely measured in ambient air monitoring networks. $NO_2$ measurements also typically include measurement of NO, the other major NOx constituent.

## Volatile Organic Compounds (VOCs)

VOCs refers to a number (hundreds) of individual organic compounds which include non-methane hydrocarbons (NMHC) and oxygenated NHMC such as alcohols, aldehydes and organic acids. They are emitted by a wide variety of sources, and many hydrocarbons are associated with the use and production of fuels. Specifically, VOCs (mainly hydrocarbons) are typically emitted from refineries and related activities (e.g. crude oil production, storage tanks leaks, transport pipelines, others) but can also originate from other industrial activities. While measurements of NMHC can provide valuable information about potential refinery emissions, for a refinery it is possible to distinguish a few specific VOCs to represent fugitive emissions that have been associated with adverse health impacts (e.g. benzene, toluene, ethylbenzene, and xylenes; or BTEX). VOC emissions also occur from other combustion sources, such as wood combustion, and stationary and motor vehicle fossil fuel combustion, and elevated levels of BTEX compounds are expected in the vicinity of major roadways. This group of aromatic VOCs is important because not only they pose risk to human health, but they also play a role in formation of tropospheric ozone. Other VOC air toxics of concern that are often reported include 1,3-butadiene and styrene.

## 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, is emitted from chemical manufacturing and waste disposal, occurs naturally in crude petroleum and natural gas, and is produced at refineries as a by-product of crude oil processing. Low-level concentrations can occur continuously at petroleum refineries and its measurement will help identify potential leaks and address community odor concerns.

## Other Pollutants and Air Toxics

In addition to the major air pollutants mentioned above there are other species that, although unlikely to be emitted in large quantities from the main source categories identified by the CSC, will also be monitored in this community if detected during our surveys. These are:

**Particulate Metals**

Metals can be emitted in trace amounts from a wide variety of anthropogenic sources such as combustion activities and facilities which conduct metal plating, forging, and heat treating. Of particular interest are nickel, mercury, copper, vanadium, lead, hexavalent chromium, and arsenic, because these species have been associated with adverse health effects in the urban environment. Measurement of metals usually involves analysis of PM filters collected over a defined time period (e.g. 24-hr) at a known sample volume. However, commercially available continuous multi-metals monitors are now available that can simultaneously measure the concentrations of several metals in hourly or sub-hourly time resolution.

**Methane**

Methane is a colorless and odorless gas, and is flammable in high concentrations (i.e. between 50,000 to 150,000 ppm). Methane is considered to be biologically inert, but can cause adverse health effects when levels are high enough to displace oxygen in the air, which can pose a suffocation hazard. However, this is generally only a concern in confined spaces rather than in typical outdoor and indoor environments where oxygen is readily available. Methane is not considered an air toxic and is not on the California Toxic Air Contaminants list, or in the

California Proposition 65 list, or in the U.S. EPA Hazardous Air Pollutants list. Methane is well known greenhouse gas and is primarily regulated through state and federal laws.

**Ammonia ($NH_3$)**
While the main sources of ammonia are natural, primarily from the decay of organic matter, petroleum refineries can also emit considerable amounts of this compound, particularly from catalyst regenerator vent releases. $NH_3$ is colorless, pungent-smelling, and corrosive. Although 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 be harmful.

**Sulfur Dioxide ($SO_2$)**
Heating and burning of fossil fuels containing sulfur release sulfur into the atmosphere, which in turn forms $SO_2$ and other sulfur containing species. $SO_2$ is classified as a criteria pollutant by the US EPA, can cause adverse health impacts if present in high concentrations in the ambient air, and can also cause damage to the environment.

**Aldehydes**
Aldehydes emitted into ambient air include, but are not limited to, formaldehyde, acetaldehyde, and acrolein that are identified as toxic air contaminants (TAC) 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.

**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 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-like effects in humans.

**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 of crude oil. At high concentrations, such as those that may derive from accidental releases, it is highly toxic.

**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. This 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 the human skin and lung tissue.

## List of Acronyms

| | |
|---|---|
| AB 617 | Assembly Bill 617 |
| AQ-SPEC | Air Quality Sensor Performance Evaluation Center |
| BARCT | Best Available Retrofit Control Technology |
| BC | Black Carbon |
| BTEX | Benzene, Toluene, Ethylbenzene, Xylenes |
| CalEPA | California Environmental Protection Agency |
| CAMP | Community Air Monitoring Plan |
| CARB | California Air Resources Board |
| CERP | Community Emission Reduction Plan |
| COS | Carbonyl Sulfide |
| CSC | Community Steering Committee |
| EJ | Environmental Justice |
| FEM | Federal Equivalent Methods |
| FRM | Federal Reference Methods |
| GPS | Global Positioning System |
| $H_2S$ | Hydrogen Sulfide |
| HAP | Hazardous Air Pollutant |
| HCN | Hydrogen Cyanide |
| HF | Hydrogen Fluoride |
| ISR | Indirect Source |
| LOD | Limit of Detection |
| LP-DOAS | Long Path Differential Optical Absorption Spectroscopy |
| LWIR | LongWave-InfraRed |
| MATES | Multiple Air Toxics Exposure Study |
| MeFTIR | Mobile Extractive Fourier Transform InfraRed |
| MSW | Municipal Solid Waste |
| NATTS | National Air Toxics Trends Stations |
| $NH_3$ | Ammonia |
| NMOC | Non-Methane Organic Compound |
| NOx | Nitrogen Oxides |
| $O_3$ | Ozone |
| OEHHA | Office of Environmental Health Hazard Assessment |
| OP-FTIR | Open Path Fourier Transform Infrared Spectroscopy |
| ORS | Remote Optical Sensing |
| PAMS | Photochemical Assessment Monitoring Stations |
| PAX | Photoacoustic Extinctiometer |
| PM | Particulate Matter |
| PM10 | Coarse PM |
| PM2.5 | Fine PM |
| PRDs | Pressure Relief Devices |

| | |
|---|---|
| PTR-MS | Proton Transfer Reaction – Mass Spectrometer |
| QAPP | Quality Assurance Project Plan |
| SkyDOAS | Sky Differential Optical Absorption Spectroscopy |
| South Coast AQMD | South Coast Air Quality Management District |
| TAC | Toxic Air Contaminant |
| UFP | Ultrafine Particles |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compounds |
| WCWLB | Wilmington / Carson / West Long Beach |