RICHMOND - NORTH RICHMOND - SAN PABLO COMMUNITY PATH TO CLEAN AIR

Update on Air Monitoring Projects in Richmond-North Richmond-San Pablo for July – September 2021

Hello from the Richmond-North Richmond-San Pablo Monitoring Outreach Team! We are examining the air in our area to learn more about the air we are breathing and inform actions that can improve it.

For the past year, we have shared updates about implementation of monitoring projects that were included in the area's Community Air Monitoring Plan, developed under California Assembly Bill 617. Read on to learn more!

What is the Monitoring Outreach Team?

Development of the Community Air Monitoring Plan was guided by a Steering Committee whose members had knowledge of the community as well as technical and scientific expertise. The Monitoring Outreach Team is made up of four community members who served on that committee: Dr. Henry Clark, Oscar Garcia, Dr. Julia Walsh, and Linda Whitmore, and is joined by Kevin Ruano-Hernandez (a local student representative). Matt Holmes previously served as a member of the team. The team meets monthly to review air monitoring information with Bay Area Air Quality Management District (Air District) staff.

Contents of This Update

- Information sources on **wildfire smoke and air quality** (page 2)
- **Details on the air toxics monitoring project** that is now underway using the Air District's air monitoring van (pages 3-8).
- **Latest updates** on local air monitoring projects and links to data, analyses, and resources (pages 9-15).

Key Takeaways

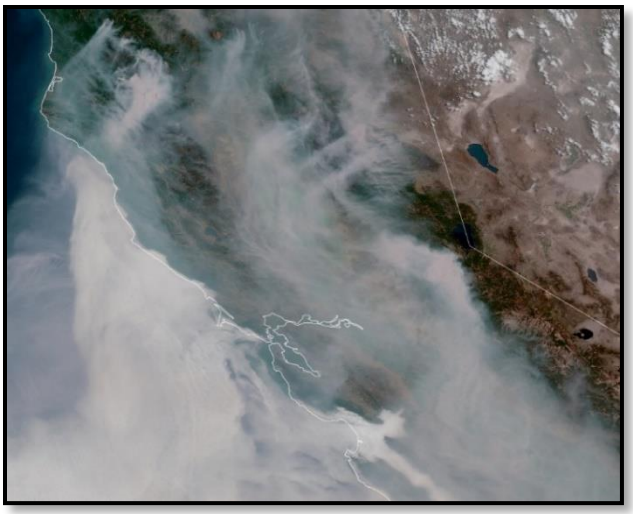
- Air quality impacts from wildfire smoke typically peak this time of year. Read on for more information about where to find real-time air quality information and how to reduce your exposure to wildfire smoke.
- The Air District is collecting data using its air monitoring van in parts of the Richmond-North Richmond-San Pablo area as part of an air toxics monitoring project. You may see the monitoring van in your neighborhood! A brochure about the van contains more details – help us get the word out about this project! Brochure: English | 中文 | Tagalog | Español | tiếng Việt

Questions? Feedback?

- There are several ways to contact us. We'd love to hear from you!
  - Ask questions via a short Google form: https://forms.gle/saZJXMV5GP5UfAm86.
  - Email us at: ab617info@baaqmd.gov
  - Call us at: 415-749-4900
- You can also visit the Air District's website to learn more: http://www.baaqmd.gov/ab617rsp

Wildfires and Air Quality

Autumn is typically the peak of wildfire season in California. As we have experienced here in recent years, smoke from wildfires can severely impact air quality, sometimes for days and weeks at a time. Real-time air quality data are now available from sensors located across the Richmond-North Richmond-San Pablo area, and those data can help inform your decisions to reduce your exposure to unhealthy air quality. The Air District's website will display a banner when Smoke Advisories are in effect for the area, and the Air District's Wildfire Safety page has links to air quality data and forecasts, tips on how to prepare for wildfire smoke, and actions to take when wildfire smoke affects our area. Some specific links that may be useful are also listed below.



Satellite image of wildfire smoke over Northern California in September 2021

- Resource Guide for air quality monitoring data websites
- Frequently asked questions on air quality data sources and monitoring
- Wildfire smoke preparedness tips: English | 中文 | Tagalog | Español | tiếng Việt
- Wildfire smoke and COVID-19 website from the Centers for Disease Control and Prevention

Status Updates on Community Air Monitoring Projects

The Community Air Monitoring Plan includes several different air monitoring projects:

- **Mobile measurements:** Aclima
- **Air quality sensor network:** Groundwork Richmond and Ramboll
- **Air quality sensor network:** Physicians, Scientists, and Engineers for Healthy Energy (PSE) and Asian Pacific Environmental Network (APEN)
- **Mobile measurements of Air Toxics:** Air District

The Community Steering Committee selected these projects to collect air monitoring data across the Richmond-North Richmond-San Pablo area for several purposes, including to: 1) provide real-time air quality information; 2) improve overall understanding of air quality in the area, 3) identify locations where air pollution levels are persistently or unexpectedly higher, particularly near specific sources of pollution, and 4) better understand levels of air toxics near specific sources of concern. Detailed information about these projects can be found in the Community Air Monitoring Plan and on each project's individual webpage.

Below, more information is provided on these projects, starting with a deeper dive on the Air District's air toxics monitoring project that is getting underway.

Also new to this quarterly update is information from the Assessment of Coal Air Pollution Project (ACAPP), a project conducting monitoring related to coal and coal train operations near Levin Terminal. More information on ACAPP is provided on pages 13-15.

Air Toxics Monitoring Project: Update from the Air District

A key component of the Community Air Monitoring Plan is an air toxics monitoring project using the Air District's air monitoring van. This project will focus on monitoring for several common air toxics compounds in the vicinity of known sources of air toxics in the Richmond-North Richmond-San Pablo area and in adjacent neighborhoods.

As was noted in previous quarterly updates, while under shelter-in-place orders due to the COVID-19 pandemic, the Air District team continued efforts to prepare the monitoring van and its equipment. Collection of monitoring data is now underway, and you may see the air monitoring van in your area. Help us get the word out about this effort!

Brochure: English | 中文 | Tagalog | Español | tiếng Việt

Read on for more details on this important project, including background information on air toxics and health considerations, sources of air toxics in the community, capabilities of the Air District's air monitoring van, target monitoring areas, and project timeline.

What are Air Toxics?

Air toxics are pollutants that are known or suspected to cause cancer or other serious health problems. Many kinds of pollutants are considered air toxics, and air toxics are often grouped in categories based on their chemical and physical properties. Examples of categories and compounds within those categories include:

- Volatile Organic Compounds (VOCs), such as benzene and formaldehyde
- Polycyclic Aromatic Hydrocarbons (PAHs), such as naphthalene
- Particulate metals, such as lead, mercury, cadmium, and iron
- Diesel Particulate Matter (DPM)

Unlike common air pollutants like ozone and $PM_{2.5}$, air toxics do not have ambient air quality standards, and there is no determined level of air toxics that can be considered "safe". In addition to cancer, air toxics can cause developmental and reproductive effects, neurological disorders, or other chronic or acute health effects in humans. Some agencies, such as the California Office of Environmental Health and Hazard Assessment (OEHHA), have established reference exposure levels (RELs) and cancer risk factors for certain air toxics. Measurements of benzene (a VOC) in the Richmond-North Richmond-San Pablo area were compared to these reference levels in a previous quarterly monitoring update.

The air toxics monitoring under this project using the Air District's air monitoring van will focus primarily on Volatile Organic Compounds (VOCs). These are compounds that contain carbon, react photochemically in the atmosphere, and evaporate easily.

Sources of Volatile Organic Compounds (VOCs)

VOCs can come from many kinds of products, processes, and facilities. Some of these sources are very common and are found throughout areas where people live, while other sources are more localized. While VOCs can also come from many indoor and household products, this information focuses on sources of VOCs in outdoor air.

Combustion of fuels (like coal, diesel, gasoline, wood)

Biomass burning (smoke from wildfires, agricultural fires, and prescribed fires)

Gas stations, auto body shops, print shops, and dry cleaners

Landfills, scrapyards, and water treatment facilities

Oil and gas refining, processing, transport, and storage

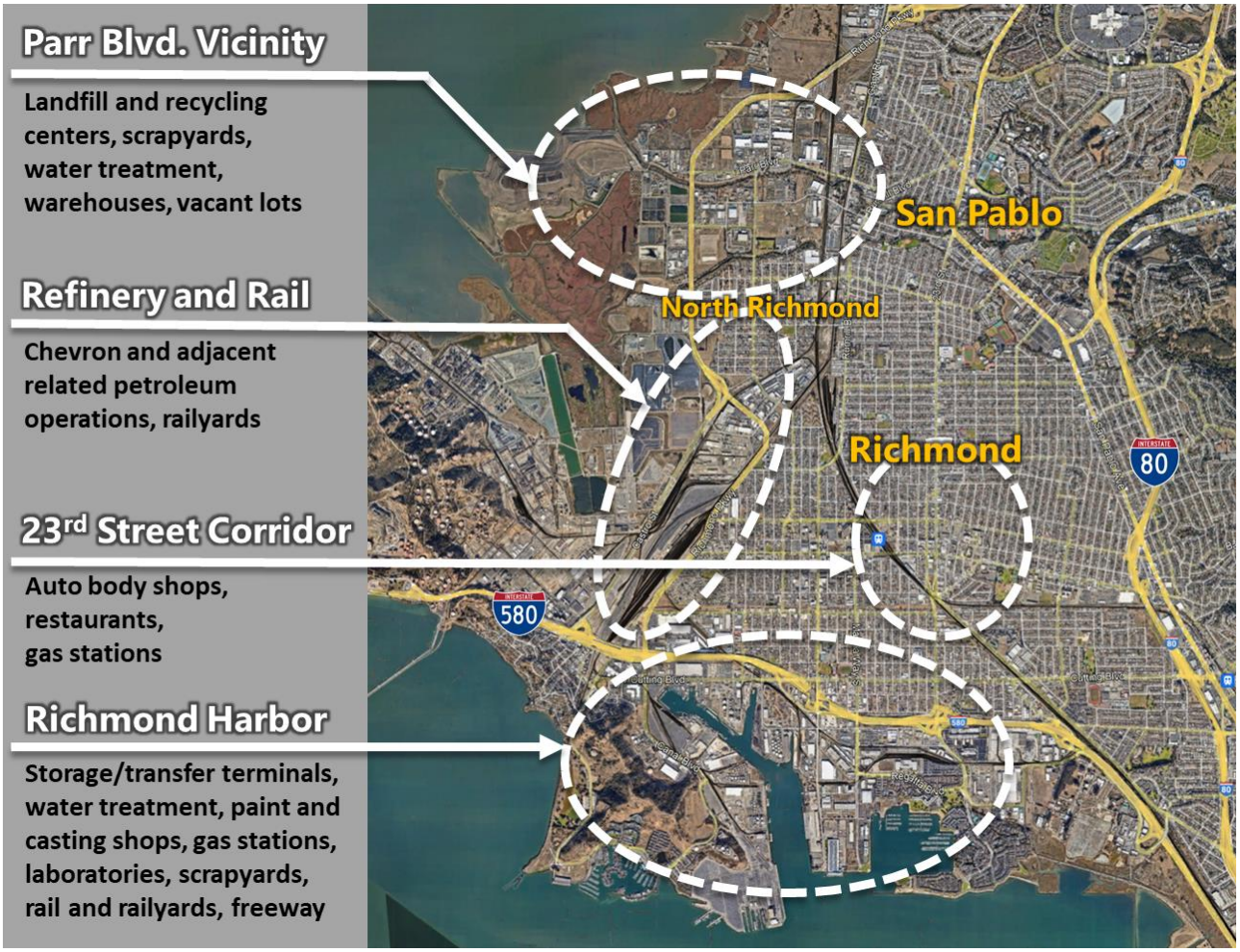
Existing Monitoring for Air Toxics

Measurements of different air toxics are currently collected at fixed-site monitors in the Richmond-North Richmond-San Pablo area, as described in the March 2021 quarterly monitoring update. The specific air toxics measured, instrumentation used, data frequency and accuracy, and purpose(s) for monitoring vary across these systems, and the data provided have different uses and considerations. The Air District's fixed-site monitors collect highly accurate data that date back several years, providing information on how air toxics levels have changed over time. However, their geographic coverage is limited.

The Air District's new air monitoring van can collect data in more areas and measures for a wider range of compounds than existing fixed-site monitoring systems. This new information will help to better understand the geographic variability in air toxics levels, locate areas where levels of these air toxics are unusually high, and identify possible sources for those higher levels.

Target Sources and Areas for Monitoring

The map below provides a general idea of target monitoring areas for this project. These areas are around known sources of VOCs and overlap with community-identified sources of concern and places where people spend time. The general areas shown on the map do not indicate the exact monitoring areas for this project.



Air Monitoring Van Capabilities and Operations

Over the last several months, the Air District has been working towards the completion of a specialized van that will be used to carry out the air toxics monitoring campaign in the Richmond-North Richmond-San Pablo area. As the air toxics monitoring project gets underway, we wanted to share some information about the capabilities of the air monitoring van, what daily operations will look like, and our latest progress to collect high quality air toxics data.

Air Monitoring Van Capabilities

The Air District's air monitoring van is uniquely outfitted with the following elements to further understand air toxics and related air quality in the Richmond-North Richmond-San Pablo area:

- Primary instrumentation dedicated to measuring air toxics, including many VOCs at trace levels
- Secondary instrumentation used for source identification and gathering a larger pollution profile
- Auxiliary instrumentation for capturing meteorological and van location data
- Comprehensive data collection, storage, and visualization tools to make sure the data are accurate
- Air monitoring van data are collected once every second for high spatial data resolution
    - A single day of on-road air monitoring yields millions of data points!
- Additional power system allows for continuous on-road measurements or short-term stationary measurement periods at locations of interest

Each one of the elements listed above has been customized or chosen specifically to work with the van's dimensions, on-road conditions, and data collection needs.

(Left) Proton Transfer Reaction Mass Spectrometer (PTR-MS), one instrument in the Air Toxics Monitoring Van that can accurately identify many different VOCs at the same time and at very low concentrations. (Right) Air Toxics Monitoring Van secondary instrumentation and data components.

Daily Operations

The Air District has been monitoring air quality for decades, although making on-road mobile air measurements is new. Drawing on this experience in monitoring, the Air District has developed protocols and best practices to ensure high quality data with the mobile approach. The following section highlights daily van operations, focusing on safety and data quality control.

Once the drive plan for a given day is set, two Air District staff are needed to operate and collect data with the van. The day begins with running through a thorough pre-drive checklist, including van safety checks, instrument warm-up, verifying each instrument is functioning properly, navigation preparation, and activating data collection systems.

Once the air monitoring van is ready to go, we drive to the area of interest and begin taking air measurements. The two Air District staff members onboard each have unique and important roles. While the driver pilots the van safely along the planned route, the passenger monitors all instruments and data systems through real-time data visualization tools, makes specific log notes about the incoming data and drive details.

After data collection is finished, instruments on the van undergo another round of checks to ensure data are valid, and data are saved and organized.

Air District staff performing post-drive quality control checks on air quality instrumentation in the Air Monitoring Van.

Air Monitoring Van driving to measurement area.

The final step of the operations process consists of data post-processing, review, and quality control. This is a very thorough procedure and requires combing through the data checking for new pollution signals, potential issues, and documenting all activities. After this stage, the data are shared with Air District scientists for further analyses.

Current Status

Progress has continued with the Air District's air monitoring van in completing a series of robust in-motion and live tests to ensure measurement and data systems are working properly. The initial testing phases are complete and simulated field driving scenarios are underway, in addition to efforts to hone data post-processing, data review, and quality control tools. This phase also includes capturing real-world data in the Richmond, North Richmond, and San Pablo area. Once the driving scenarios have been completely mapped out and data handling tools are ready, data capture will increase to a full-time basis.

Image of the Air Monitoring Van featuring artwork designed and created in collaboration with RYSE Youth Center. Van decals are in English and Spanish.

Air Toxics Monitoring Timeline and Next Steps

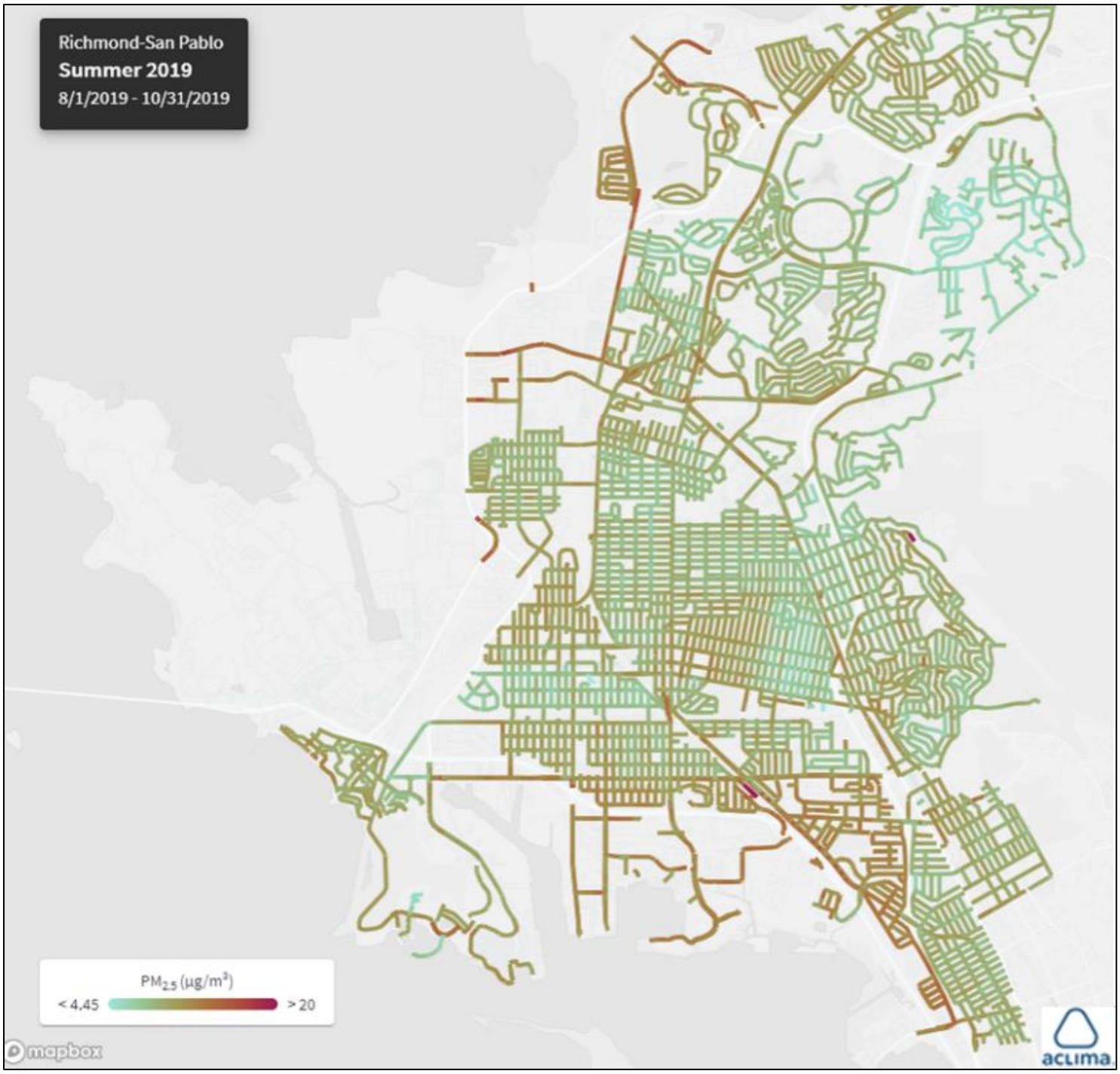
The air toxics monitoring van project timeline is visualized in the graphic below. In addition to the project planning and data collection, data review and analyses take considerable time and resources. We expect to have initial findings to share in the next few months, and the Monitoring Outreach Team will help develop a fact sheet to communicate those findings to the public. Stay tuned!

Air Toxics Monitoring Project Timeline

- Refining Air Toxics Monitoring Van driving strategies, data review/analysis tool development (Summer/Fall 2021)
- Data collection begins (Fall 2021)
- Ongoing review and analysis as data are collected (Fall 2021)
- Share initial findings (Late 2021 – Early 2022)

Status Update on Aclima: Mobile Measurements

In March 2021 Aclima released a web-based report highlighting areas where their monitoring data collected in August, September, and October 2019 across Richmond-North Richmond-San Pablo showed persistently higher levels of $PM_{2.5}$. The report can be found here: https://rspreport.aclima.tools/.



Screenshot from Aclima's $PM_{2.5}$ analysis report, available here: https://rspreport.aclima.tools/

Status Update from Ramboll and Groundwork Richmond:
Air Quality Sensor Network

Clarity Nodes:

54 Clarity nodes deployed total (measuring $PM_{2.5}$ and NO_2 but analyses focused on $PM_{2.5}$) with about 45 nodes healthy and reading in data (for map, see links below). We provided a Clarity node refresher training for GWR.

- Real time model with sensors included and mapped: https://app.ramboll-shair.com/richmond
- Just the sensors mapped: https://openmap.clarity.io/

Shair Model

The real-time model and sensor network is live through 2021 due to the second round of the CARB community air grant, accessible here. The real-time model utilized a network of PurpleAir and Clarity nodes to model hyper-local concentrations. The Clarity node subscription ended September 23rd, and there was a week from September 23rd to 30th when the Shair map was not using real-time Clarity measurements. After September 30th, Clarity generously extended the subscription to the end of the year. Ramboll has backfilled the missing data, and the real-time maps will have Clarity node measurements along with Purple Air. Ramboll is preparing a source apportionment study based on 2020 data which will be summarized in a dashboard. We highly encourage members of the community to check this map regularly for real-time hyper-local air quality, especially during fire season. There is a live (coarser) map of air quality in the entire Bay Area, accessible here.

Gravimetrical PM Sampling

Gravimetric PM sampling with the MiniVol samplers was completed, and the interactive dashboard of the analysis is accessible here.

Black Carbon Monitoring

Black carbon monitoring is ongoing at 4 sampling locations in Richmond through November. AethLabs has confirmed that there has been no signs of water intrusion after the redeployment of the monitors at the end of Q2, which had been a problem before that caused monitors to not work correclty. Data analysis is underway, with an emphasis on source allocation from fossil fuel combustion and biomass burning. A dashboard with findings will be available at the end of the year.

Next steps:

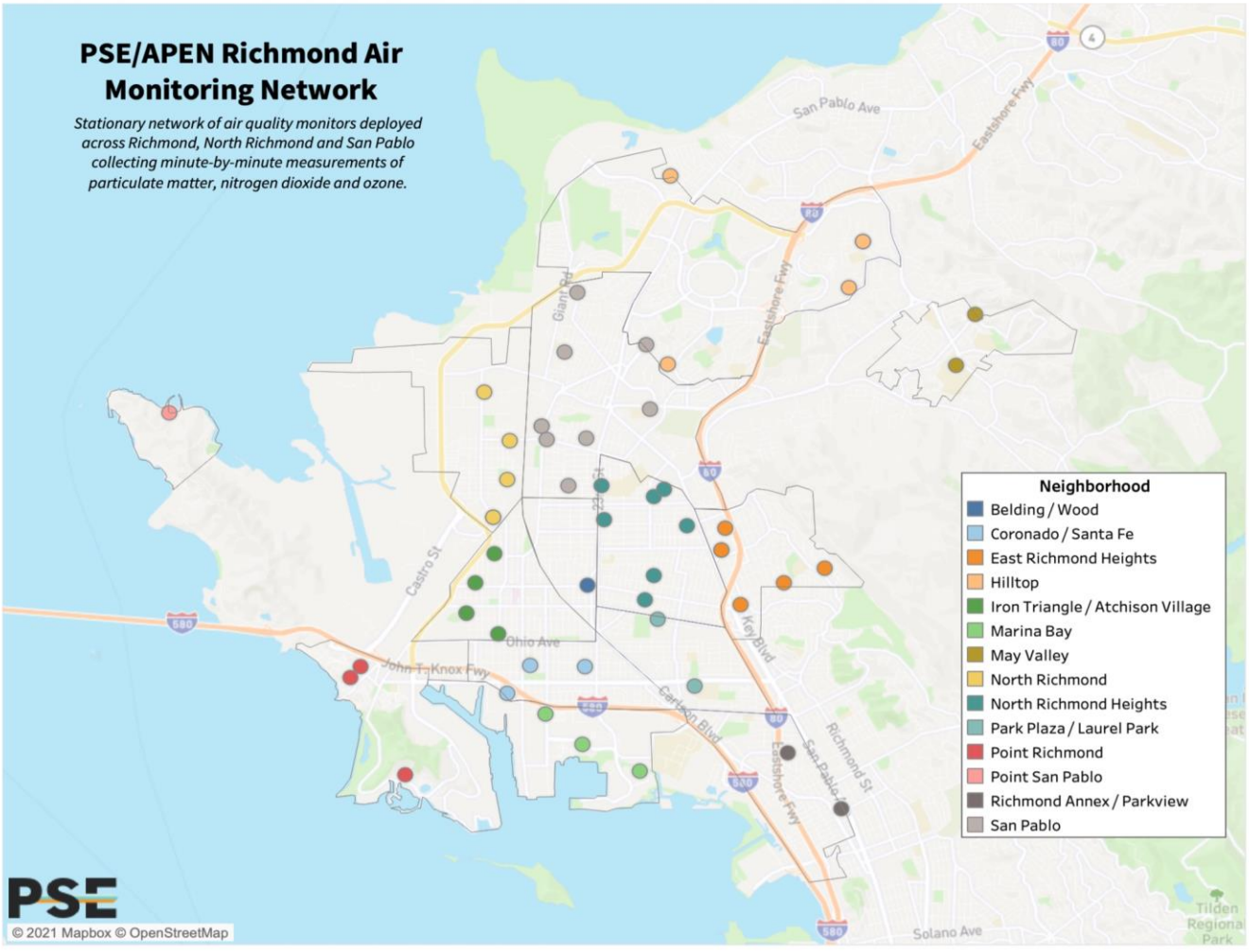
- The real-time model and sensor network will continue to operate through 2020.
- Source apportionment results from the first full year of operation, 2020, will be summarized in a dashboard
- Black carbon monitoring will continue through November 2021.
- Black carbon monitoring SOP and Deployment Protocol for the Aethlabs MA350 will be completed.
- Black carbon data analysis will be summarized in a dashboard, showing source apportionment findings

Status Update from PSE and APEN:

Air quality sensor network

Physicians, Scientists, and Engineers for Healthy Energy (PSE), in collaboration with the Asian Pacific Environmental Network (APEN), first began collecting air quality data in Richmond and San Pablo in January 2020, with air monitoring efforts planned to continue through Spring 2022. We continue to collect real-time air quality data in one-minute intervals from our network of 52 stationary Aeroqual AQY micro air quality monitors. 50 monitors are measuring particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), ozone (O_3), temperature, relative humidity, and dew point. Two prototype monitors are measuring $PM_{2.5}$, volatile organic compounds (VOC), carbon monoxide (CO), temperature, relative humidity, and dew point.

The map below shows air monitors deployed throughout the various designated neighborhoods in Richmond and San Pablo. In partnership with Aclima, current air quality data and historical data (up to 90 days) collected through the network are available to view in real time. Our recent PSE blog features preliminary analysis of air quality data collected from the Richmond Air Monitoring Network, including a discussion of neighborhood trends in air pollutant concentrations.



Status Update from PSE and APEN, continued

Phase II: Black Carbon

In collaboration with researchers at the Lawrence Berkeley National Laboratory, we have completed three one-month-long monitoring campaigns to collect black carbon measurements. These campaigns use Aerosol Black Carbon Detectors that are co-located with our stationary network sites. The first deployment occurred during a wildfire smoke event in August 2020 and the second deployment occurred during the winter months of January and February 2021. The third and final deployment, slated for summer months, was completed in May and June 2021. We are now in the process of analyzing the black carbon data.

Next steps

- Our data collection, data validation, and data analysis efforts will continue into spring 2022 and we will continue to provide updates to the community.
- We are collaborating with Lawrence Berkeley National Lab researchers on cleaning and analyzing black carbon data collected during the wildfire deployment (August 2020), winter deployment (January/February 2021), and summer deployment (May/June 2021).

Relevant project links

- Richmond Air Monitoring Network: Project Landing Page
- Richmond Air Monitoring Network: Interactive Air Quality Data Visualization Tool
- PSE Blog: Richmond Air Monitoring Network Insights: Using hyperlocal data evaluate to neighborhood trends in air pollution (September 2021)
- PSE Analysis: Preliminary Data Analysis Update (July 2021)
- Berkeley Lab Feature: Empowering a Neighborhood to Breathe Easy (July 2021)
- PSE Blog: Richmond, CA Air Monitors Show Cleaner Air During Bay Area COVID-19 Lockdown, With A Catch (April 2020)

Questions?

Questions or inquiries regarding the Richmond Air Monitoring Network, please contact:

Boris Lukanov, PhD
Senior Scientist, PSE Healthy Energy
blukanov@psehealthyenergy.org

Status Update from the Assessment of Coal Air Pollution Project (ACAPP)

ACAPP aims to measure particulate matter related to the transport, storage, and handling of coal and petroleum coke. It also aims to estimate the resulting health consequences of exposure to this particulate matter. This project came together because there is extensive activity related to transport, storage and handling of coal and petroleum coke in Richmond as well as proposals for these activities in Oakland. However, the setting of these industrial activities raises health and environmental justice concerns because of nearby residential communities that are disproportionately burdened by multiple sources of pollution, low income, and high underlying health problems. Additionally, these industrial activities support the burning of fossil fuels which have significant climate change impacts. ACAPP aims to inform decision-making by estimating the health implications of these industrial activities. The project includes three general tasks: 1) measuring particulate matter associated with the Levin terminal, specifically coal and petroleum coke particulate matter related to their storage and handling and related to storage in railcar holding locations, 2) measuring particulate matter associated with moving coal trains, and 3) estimating health impacts resulting from exposure to this particulate matter. Due to slow downs related to the pandemic, ACAPP expects to collect data through 2022. Currently the project has produced pilot data that demonstrates that the sites are working and that various technical issues have been resolved.

Task 1: Terminal Monitoring

There are two main components to the terminal monitoring portion of ACAPP: active monitoring and passive monitoring.

Active Monitoring

Active monitoring is currently underway at sites near the terminal. These sites have been operating in a pilot capacity since October 2019. The stations actively collect 8 particle size fractions at 3-hour time increments and the samples are taken to the UC Davis lab for speciation analysis, meaning they are analyzed for various characteristics to determine the concentration of particles that are coal or petroleum coke related. Figure 1 provides images of these stations, which include pole-mounted weather stations documenting wind speed and direction and temperature / relative humidity that can be correlated to the fluctuations in particle concentrations. These sites deploy custom particle counters that are the same as commercial PurpleAir PA-II units except they use 3 channels instead of 2 to reduce ambiguity and provide a precision estimate as well as 1 second data instead of 45-90 seconds, in order to effectively capture train passing events.

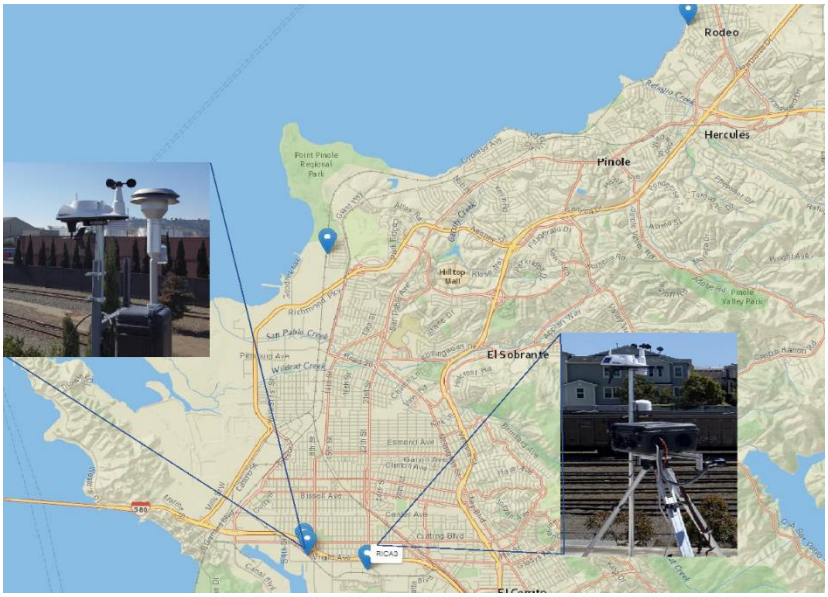


Figure 1: images showing the type of equipment used in the monitoring sites, including air particle monitors, meteorological stations, and cameras.

Status Update from ACAPP, continued

Figure 2 provides an image of some of the pilot sample concentrations measured at these stations, showing the relative contribution of different particle sizes and showing how they track to regional concentrations. Now that the stations are running with all inputs properly coordinated, and with industrial activity resuming, ACAPP will begin full monitoring at these sites.

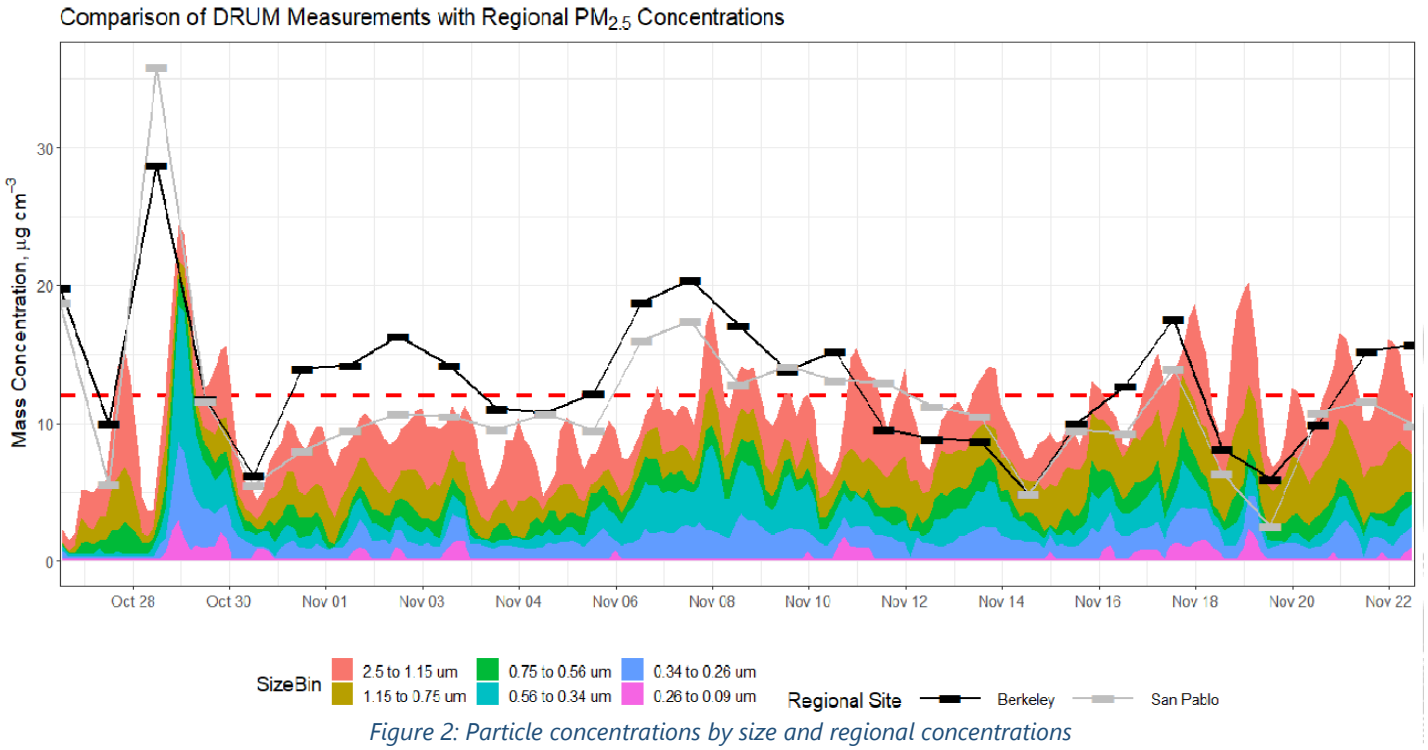


Figure 2: Particle concentrations by size and regional concentrations

Passive Monitoring

At these same sites near the terminal, ACAPP is also conducting passive monitoring, meaning that trays are placed to continuously collect particles without actively sorting by particle size or assessing concentration. The samples are then sent to a third-party lab where scanning electron microscopy analysis / single particle analysis is conducted to identify whether any of the particles are coal and/or petroleum coke. This passive monitoring thus provides specific confirmation of the presence of these industrial pollutants, though not of their concentrations. ACAPP has had two deployments of these passive monitors, in summer 2020 and winter 2021. Figure 3 shows an image of a coal particle that was captured in the passive monitor and the associated graphic shows the chemical profile that confirms the particle identity.

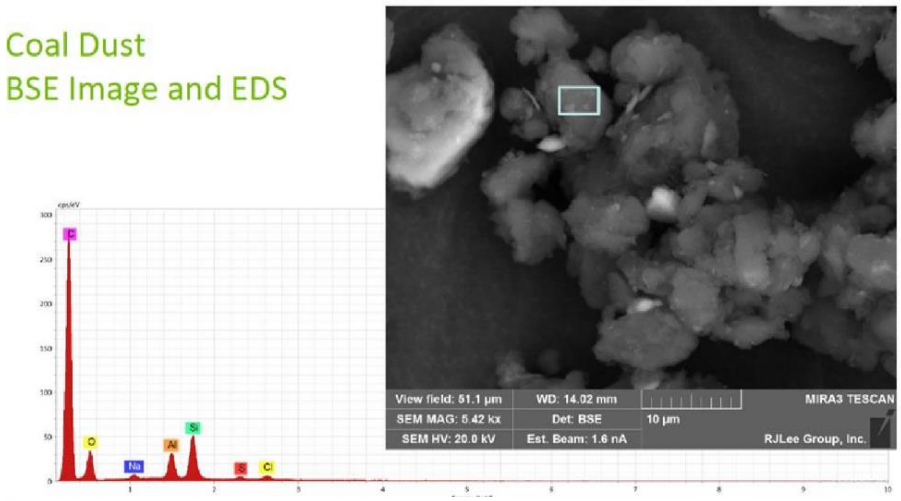


Figure 3: Image of coal particle detected in the passive monitor and corresponding chemical constituents

Status Update from ACAPP, continued

Task 2: Mobile train monitoring

Since coal is transported in open train cars, sometimes a mile long, it is important to understand what particulate exposures are associated with rail transport. To do so, however, is a complicated endeavor. ACAPP has overcome several technical challenges involved in detecting and getting video documentation of passing trains and coordinating that information with particle concentrations and meteorological data. Figure 4 shows how these monitoring sites use infrared spotlights for "night vision" good enough to capture images of passing trains that ultimately can be used to distinguish coal trains from other trains. ACAPP is using Artificial Intelligence (AI)-driven image classification camera systems to do so. To identify the trains involves supervised training of the AI system to classify various source types, e.g., coal-bearing trains, freight trains, Amtrak, CalTrain. Figure 5 shows a video image where AI has detected the presence of a train. Future training will distinguish whether this is a coal train. Figure 5 also shows the iterative process of recording footage at the monitoring site and then training the AI system to identify the presence of a train.

Figure 6 shows how the monitoring station captures a change in particle concentration that occurs when a train is passing. Corresponding wind and track orientation information triangulate with the corresponding video to indicate that this fluctuation is due to the passing train. With these initial challenges resolved, ACAPP will advance its AI training to specify coal trains from among other passing trains.

Task 3: Health Assessment

With the Task 1 and 2 milestones met, ACAPP will soon be producing fully integrated monitoring data, at which point the third task, assessment of resulting health impacts, will occur.

Figure 4: Image of freight train, possibly coal, documented by infrared camera system and identified by AI system

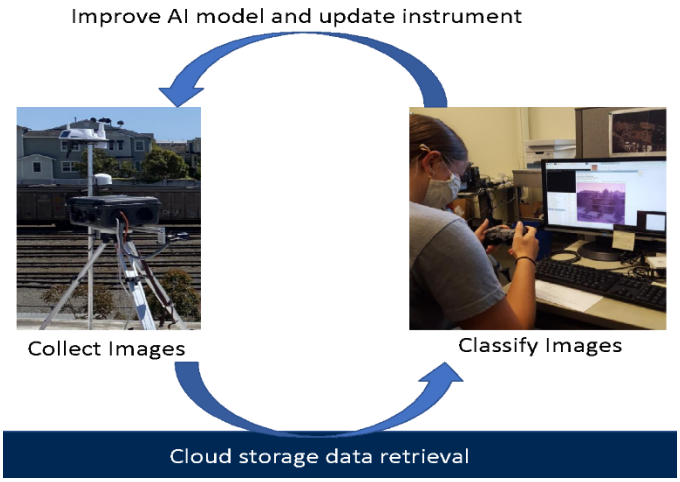


Figure 5: Illustration of the process of training the AI system to identify trains from footage collected at monitoring station

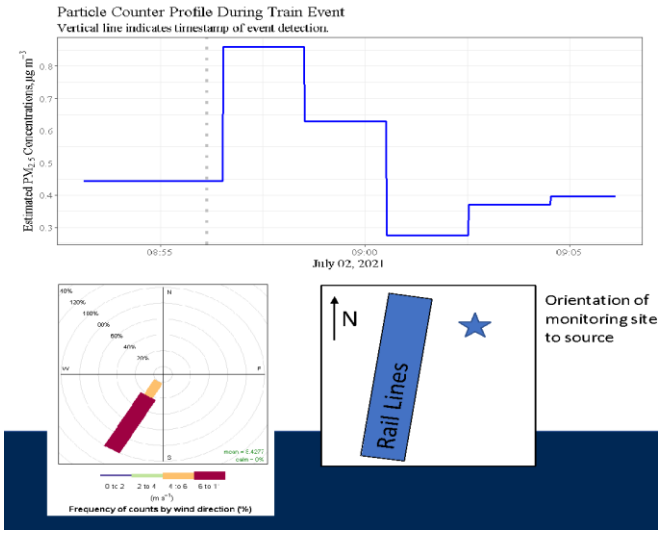


Figure 6: Image of change in particulate concentration, corresponding wind direction and orientation of the monitoring station to the train