Update on Air Monitoring Projects in Richmond-North Richmond-San Pablo for April – June 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.

Every three months, we share updates about implementation of the various 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

- **Updates** on local air monitoring projects and links to data, analyses, and resources (pages 2-6).
- **Fact sheets** prepared by the Air District on trends particle pollution levels and exploring particle pollution levels in Richmond-North Richmond-San Pablo (pages 7-11).

Key Takeaways

- Recent severe wildfire events caused higher levels of particle pollution. Those higher levels make it more difficult to determine whether $PM_{2.5}$ levels are improving overall from reductions in other pollution emissions and to identify areas that may have higher pollution levels due to local pollution sources.
- Staff are analyzing air monitoring data to help identify areas with higher air pollution levels. Two areas showing occurrences of higher levels of particle pollution are described on pages 8-11 of this update. Community knowledge of the area may help the Monitoring Outreach Team better identify and understand the sources of these higher pollution levels.
- The Air District will soon be 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. 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

Status Updates on Air Monitoring Projects

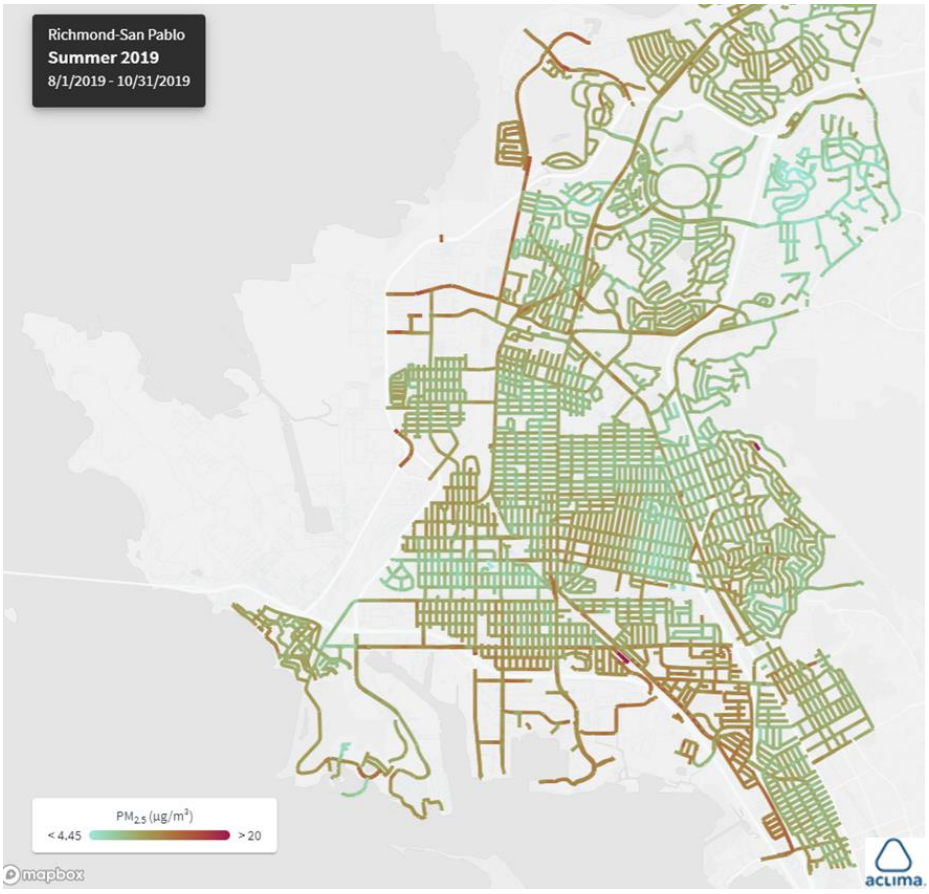
The Community Air Monitoring Plan includes several different air monitoring projects:

- **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. Updates on these efforts are provided below.

Status Update on Aclima: Mobile Measurements

In March 2021 Aclima released a web-based report highlighting areas where their monitoring data in Richmond-North Richmond-San Pablo showed persistently higher levels of $PM_{2.5}$, available 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 have been 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).

- 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 are live through 2021 under the second round CARB community air grants.

- It is accessible here: https://app.ramboll-shair.com/richmond *(same as linked above)*
- More info on data and analyses were presented at a webinar in February 2021. You can watch the webinar recording and view presentation slides at https://americas.ramboll.com/webinar/shair-air-quality-map.

Gravimetric PM Sampling

Gravimetric PM sampling with the MiniVol samplers is almost completed. Groundwork Richmond had their monitoring van vandalized in March 2021 which delayed the last set of sampling. A near-final interactive dashboard of the analysis can be found here and can be shared with the public.

Black Carbon Monitoring

Black carbon monitoring using Aethlabs MA350 at 5 sampling locations in Richmond was paused in early April. There was an issue with water intrusion with one of the instruments and they were all shutdown to avoid further damage. We are currently working with Aethlabs and the Groundwork Richmond Air Rangers to re-configure the monitors to prevent water damage. Our learnings will be included in an SOP slide deck and Deployment Protocols document. The monitors were re-deployed late June at four sites. A Groundwork Richmond intern is working with the black carbon data that were available before the monitors were turned off and presented her findings to the Monitoring Outreach Team in June 2021. The presentation with analyses and findings can be found here and a map of the black carbon monitoring sites can be found here. The Fire station 62 monitor was damaged so it is currently not operating. Aethlabs is working on repairs and determining if the site is feasible for re-deployment.

Next steps:

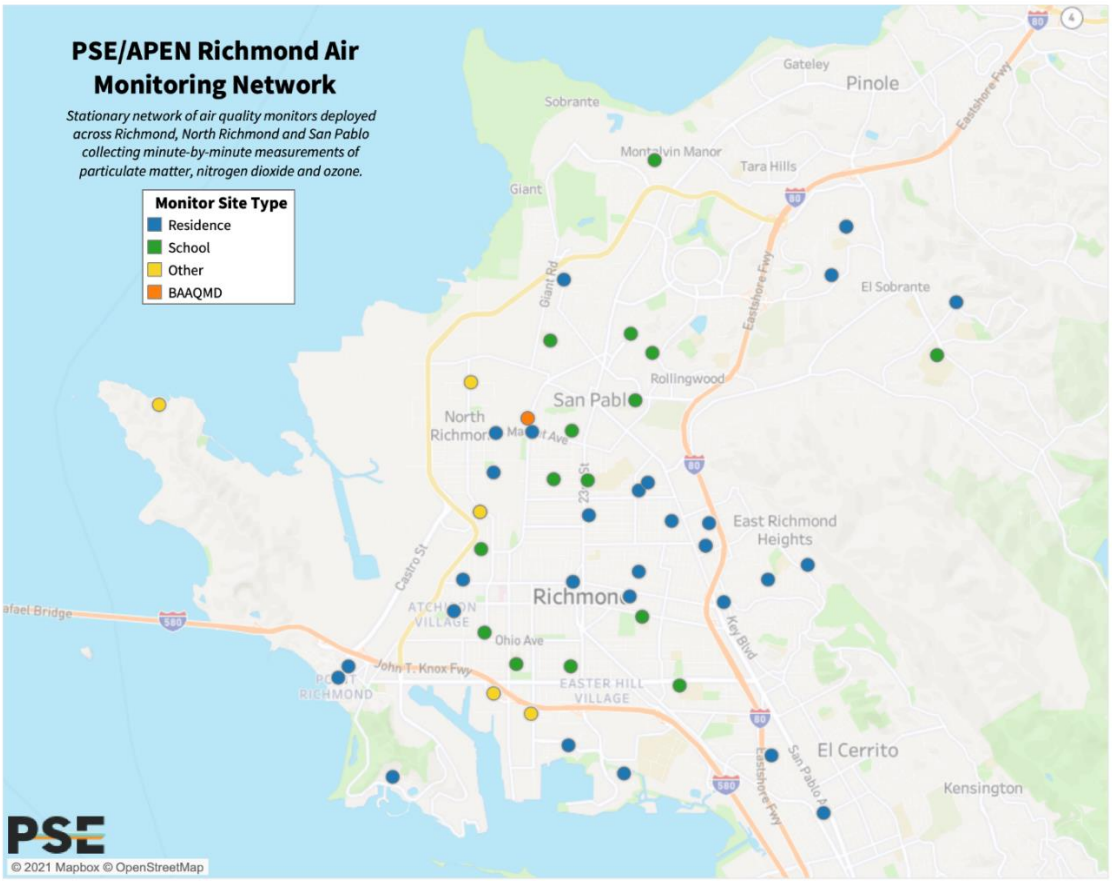
- The real-time model and sensor network will continue to operate.
- Source apportionment results from the first full year of operation, 2020, will be investigated further and summary maps will be produced.
- Black carbon monitoring will continue for the next 5 months.
- Black carbon monitoring SOP and Deployment Protocol for the Aethlabs MA350 will be written.

Status Update from PSE and APEN: Air quality sensor network

Bringing science to energy policy

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. Currently, we have 52 stationary Aeroqual AQY micro air quality monitors (pictured right) deployed and collecting real-time air quality data in one-minute intervals. 50 monitors are measuring particulate matter (PM2.5), nitrogen dioxide (NO2), ozone (O3), temperature, relative humidity, and dew point. Two prototype monitors are measuring PM2.5, volatile organic compounds (VOC), carbon monoxide (CO), temperature, relative humidity, and dew point.

As shown in the map below, the majority of deployed air monitors are hosted by community volunteers at local residences, with additional monitors located at local schools and a few other locations. Additionally, two monitors are collocated at the BAAQMD regulatory air monitoring station in San Pablo. In partnership with Aclima, real-time air quality data and historical data (up to 90 days) collected through the network can be visualized and are available to view in real time.

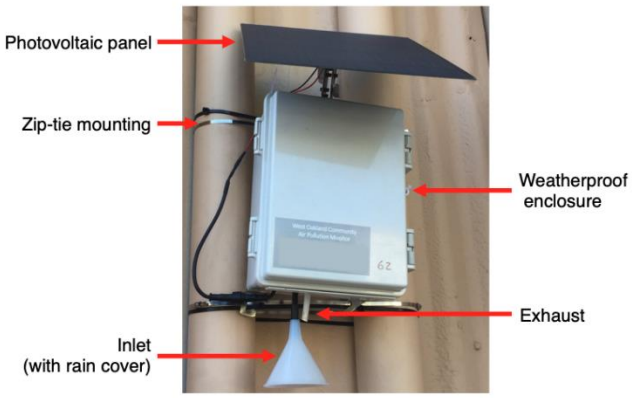


View preliminary analysis of air quality data collected from the PSE/Richmond Air Monitoring Network, including spatial hotspots of $PM_{2.5}$, pollutant concentration as a function of proximity to freeways, and average pollution concentrations by land use zoning categories (Commercial, Industrial, and Residential).

Status Update from PSE and APEN: Air quality sensor network (continued from previous page)

Phase II: Black Carbon

In collaboration with researchers at the Lawrence Berkeley National Laboratory, we are conducting three one-month-long monitoring campaigns to collect black carbon measurements. These campaigns use **Aerosol Black Carbon Detectors (ABCDs; pictured right)** that are co-located with our stationary network sites. Thus far, we have completed two of three monitoring campaigns. The first deployment occurred during a wildfire smoke event in August 2020 and the second deployment occurred during winter months of January and February 2021. The third and final deployment, slated for summer months, is currently underway (June/July 2021).



Next steps

- Our data collection, data validation and data analysis efforts will continue throughout 2021, and we will provide updates on new data.
- We are collaborating with Aclima to update the interactive real-time air quality data visualization tool.
- We are collaborating with Lawrence Berkeley National Lab on cleaning and analysis of black carbon data collected during the wildfire deployment (August 2020), winter deployment (January/February 2021), and current summer deployment (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, CA Air Monitors Show Cleaner Air During Bay Area COVID-19 Lockdown, With A Catch
- Berkeley Lab Feature: Empowering a Neighborhood to Breathe Easy

Status Update from the Air District: Mobile Measurements of Air Toxics

While still under shelter-in-place orders, the Air District team has continued efforts to ready the air monitoring van for use in the air toxics monitoring project, detailed in Appendix G of the Community Air Monitoring Plan. New efforts include in-motion tests of monitoring equipment and data logging systems, along with live testing of routing software and real-time data visualization while on the road. The collaboration between Air District and RYSE Youth Center to create artwork for the air monitoring van was completed and the decals have been applied to the van. The Air District has also released an informational brochure to help get the word out about this project and let the public know that the air monitoring van will be taking air quality measurements in the community. The brochure describes the air monitoring van project and its goals in the Richmond-North Richmond-San Pablo area, available on Richmond Area Community Health Protection Program website: www.baaqmd.gov/ab617rsp.

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

In addition to the air toxics monitoring project, the Air District continues to review and analyze available air monitoring datasets, such as data from the Air District's regulatory monitors and from lower-cost sensor networks. The next several pages of this update describe what we are learning from these analyses, including how $PM_{2.5}$ levels vary over different time periods and from place to place within the Richmond-North Richmond-San Pablo area.

Air Quality Data Analyses and Findings: $PM_{2.5}$ Trends and Patterns

The Air District is continuing to gather, review, and analyze available air monitoring data to help inform community air quality concerns data from existing air monitoring networks. Building off initial data analyses highlighted in the previous quarterly update, the current update focuses on:

- Air quality trends: How have $PM_{2.5}$ levels changed over the past decade?
- Exploring areas with higher $PM_{2.5}$ levels within Richmond-North Richmond-San Pablo

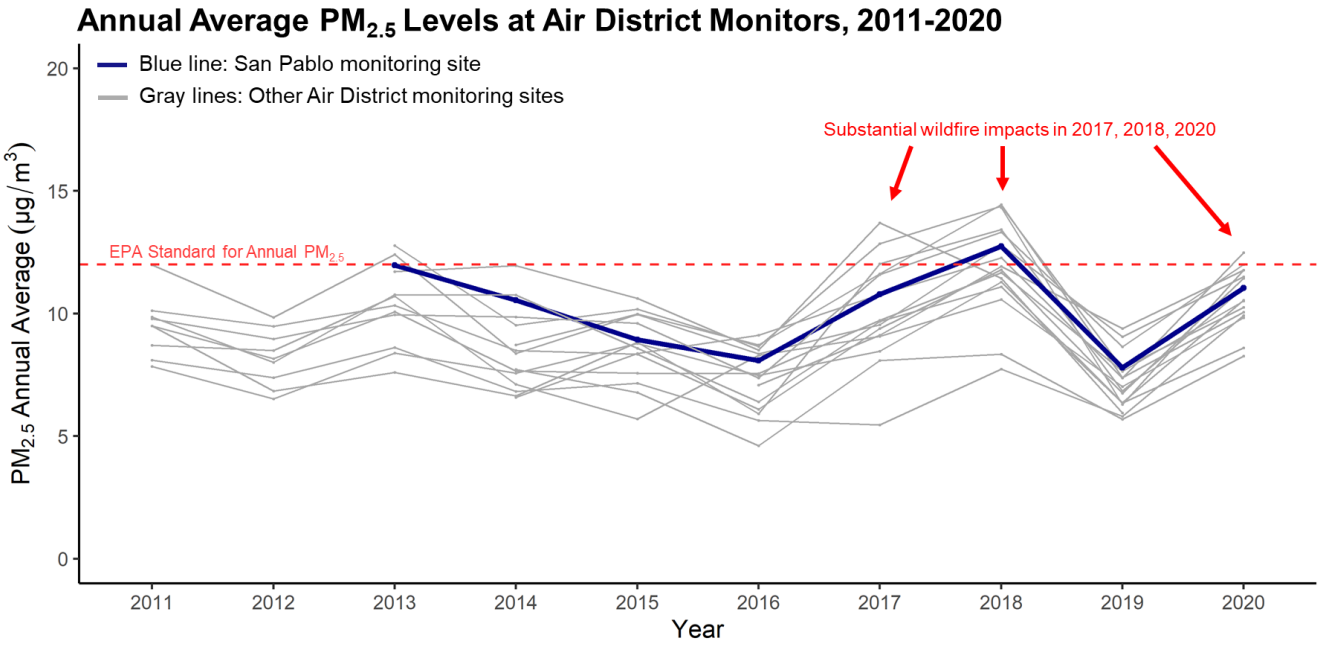
What is $PM_{2.5}$?

$PM_{2.5}$ stands for particulate matter with particle diameters of 2.5 micrometers or smaller. These **very small particles** can be emitted directly from industrial facilities, motor vehicle exhaust and brake wear, wood-burning fireplaces, wildfires, and many other sources. They can also form in the atmosphere through reactions of other pollutants. These particles are a **public health concern** because they can get deep into the lungs or bloodstream.

How are $PM_{2.5}$ levels changing?

The graph below shows annual averages of $PM_{2.5}$ levels at the Air District's regulatory monitors across the Bay Area. Data from the San Pablo monitor are highlighted in blue. Some insights include:

- For most years and at most monitors, $PM_{2.5}$ levels have been below the U.S. EPA's air quality standard for annual average $PM_{2.5}$. However, EPA recently announced plans to reexamine this standard as it may not adequately protect public health, and further reductions in $PM_{2.5}$ will have public health benefits.
- Variability in $PM_{2.5}$ levels from year to year is influenced by **changes in emissions and weather patterns**. For example, higher average $PM_{2.5}$ levels were measured in 2017, 2018, and 2020 – years with substantial wildfire events. In contrast, lower $PM_{2.5}$ levels were measured in 2016 and 2019, when wildfire smoke was less prevalent and when overall weather patterns supported better air quality.
- The wildfire events make it more difficult to tell, without additional analyses, whether reductions in other emissions are helping to improve $PM_{2.5}$ levels.



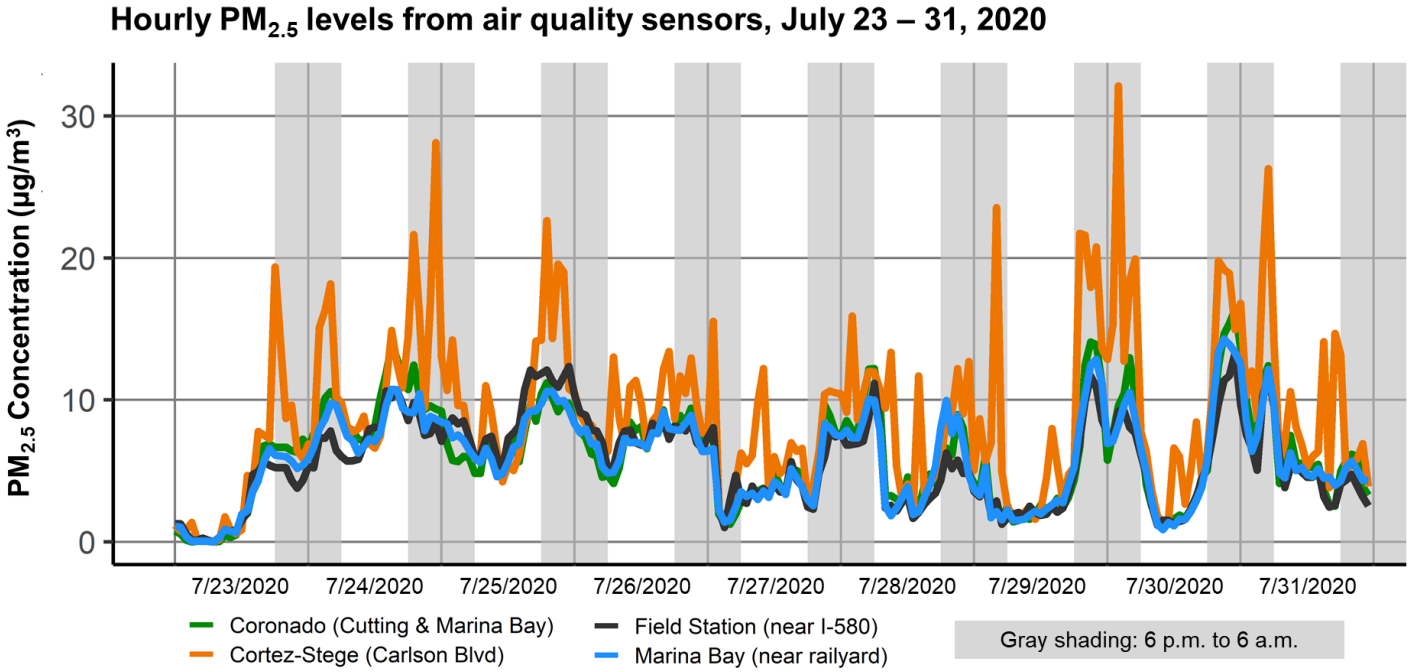
Exploring $PM_{2.5}$ Levels within the Richmond-North Richmond-San Pablo Area

The previous quarterly update included an overview of $PM_{2.5}$ data collected by the network of Clarity air quality sensors operated by Groundwork Richmond and Ramboll. The dataset was explored further and combined with other datasets to examine two areas where higher $PM_{2.5}$ levels were noted.

Carlson Boulevard (Cortez-Stege neighborhood)

Periods of higher $PM_{2.5}$ levels in the vicinity of Carlson Blvd. and Spring St. may indicate a nearby intermittent source(s) of $PM_{2.5}$. A comparison of data from lower-cost air quality sensors in the area found that:

- One air quality sensor along Carlson Boulevard **frequently showed higher $PM_{2.5}$ levels** compared to data from sensors in nearby neighborhoods (see graph below; Carlson Blvd sensor is in orange).
- These higher $PM_{2.5}$ levels often (but not always) occurred during the **evening and overnight hours**, possibly due to a source(s) that is more active during those hours. Also, wind speeds and atmospheric mixing often decrease overnight, which can allow emitted $PM_{2.5}$ to become more concentrated.
- The higher $PM_{2.5}$ levels were most evident in sensor data from summer 2020. In summer in this area, winds are predominantly from the south to southwest. **There are many possible sources of $PM_{2.5}$ nearby** from that direction, including rail operations, roadway traffic, dust from unpaved sections of Spring Street, road construction, and operations at nearby facilities along Spring Street (see maps on next page).



Lower-cost air quality sensors, like any measurement device, can sometimes malfunction and report erratic readings. However, since the readings at Carlson Blvd. sometimes do match with the readings at nearby sensors, it is more likely that the data are reflecting **actual changes in air quality**, rather than a malfunction. Aclima's recent report on the $PM_{2.5}$ data they collected also indicated **higher $PM_{2.5}$ levels in this area**.

Health metrics for $PM_{2.5}$ are generally based on longer-term exposure (such as days to years). **However, exposure to higher levels of $PM_{2.5}$ at these shorter time periods, such as hours, can still cause health impacts**, especially in individuals who already have respiratory or cardiovascular health conditions.

Map of the general area (four sensor locations are indicated by stars and color-coded to graph above)

Zoomed-in map on the area around Carlson Boulevard

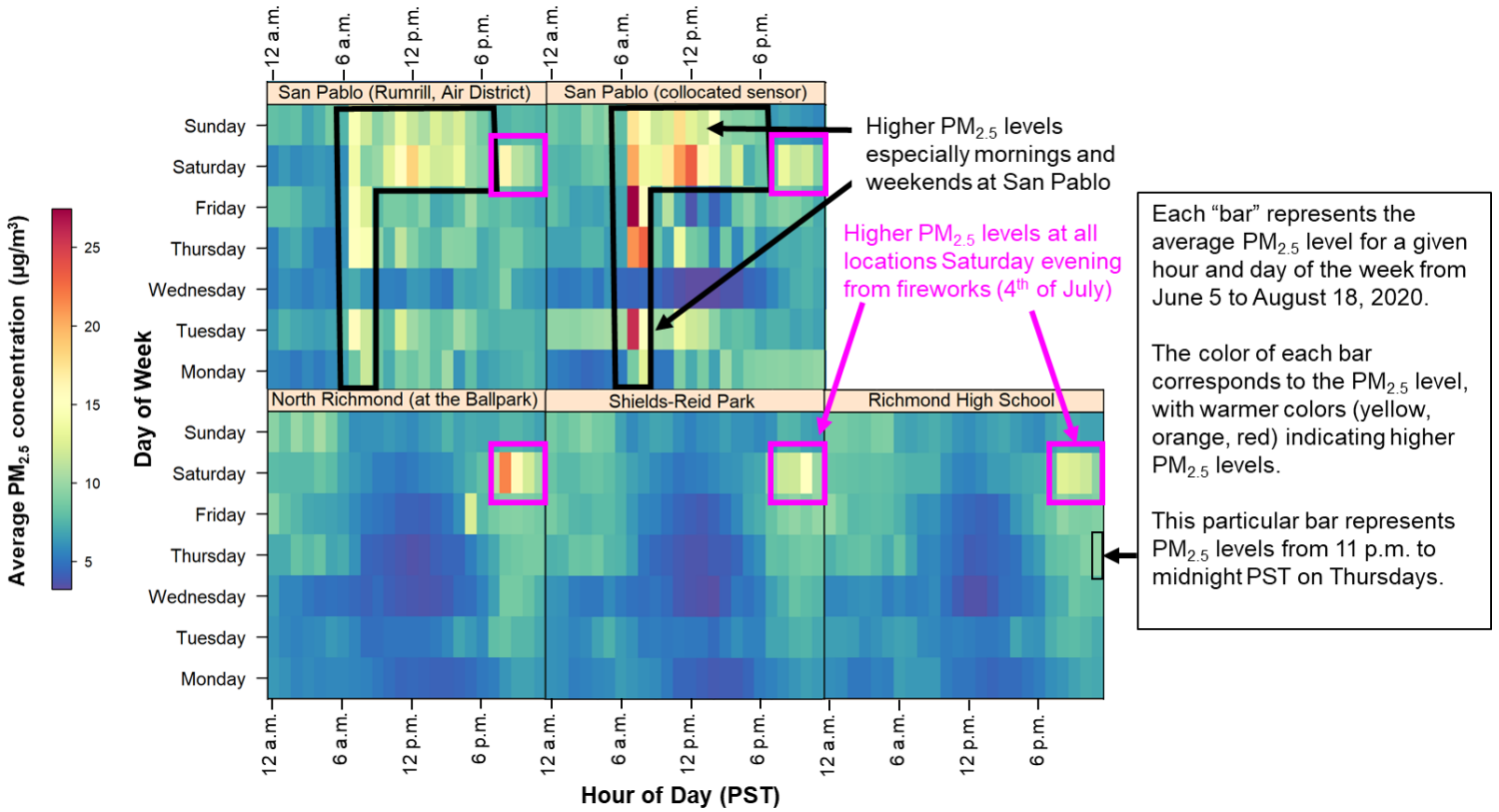
San Pablo (Rumrill Boulevard north of Market Street)

One type of analysis that can help us understand air quality is to look for patterns in **how pollution levels change throughout the day or week**, since some pollution sources emit more at certain times (such as vehicles during commute hours). In addition, patterns in air quality can be due to changes in weather conditions such as winds, temperature, humidity, and amount of mixing and ventilation.

As shown in the graphic below, this analysis revealed **different daily and hourly patterns in air quality** when comparing data from the Air District's regulatory monitor in San Pablo (Rumrill Blvd), lower-cost sensors located at the same location, and lower-cost sensors in nearby neighborhoods. Some insights from this analysis include:

- Data from the Air District's monitor (top row, left) and a collocated sensor (top row, right) show similar time of day and day of week patterns, with **higher $PM_{2.5}$ levels noted especially during mornings and weekends**.
- While showing similar patterns, the **collocated sensor shows generally higher $PM_{2.5}$ levels** than the Air District's regulatory monitor. This sometimes occurs with $PM_{2.5}$ measurements from lower-cost sensors.
- Data from sensors in nearby neighborhoods (bottom row) show **similar patterns to each other but are dissimilar to patterns at the Air District monitor and collocated sensor** (top row).
- Higher $PM_{2.5}$ levels are noted at all locations on Saturday evening. This is due to one Saturday in particular driving the average higher: **fireworks on the 4th of July**.

Time of Day and Day of Week Variations in $PM_{2.5}$ (June 5 to August 18, 2020*)



*Why is this time range shown? June 5, 2020, is when collocation of sensors at the Air District's San Pablo monitor started. And after August 18, 2020, wildfire smoke caused very high $PM_{2.5}$ levels throughout the area, making it more difficult to discern the local variability in $PM_{2.5}$ described in this analysis.

The higher $PM_{2.5}$ levels at the San Pablo monitor at specific times **may be due to a localized source(s),** as those patterns of higher $PM_{2.5}$ levels are not reflected in data from nearby neighborhoods. The map below shows the area around the San Pablo monitor, which contains **many possible sources of $PM_{2.5}$** including railways, roadway traffic, restaurant and food truck operations, automobile dismantlers and scrapyards, construction, and dust from empty lots. These patterns were not as evident in data at the San Pablo monitor prior to 2020, indicating that there may be a **relatively new source(s) of $PM_{2.5}$ in that area.**

Zoomed-in map on the area around the San Pablo air monitoring station

Wrap-up and Next Steps

Input from the community is important and highly valuable in helping identify sources of pollution! As part of the Richmond-North Richmond-San Pablo Community Emissions Reduction Plan (CERP) process that is now underway, an interactive mapping tool is being developed as one method for the public to provide input on air quality concerns. Your knowledge and experience can help us better identify and understand possible causes of the higher $PM_{2.5}$ levels that are seen in air monitoring data. The latest updates on the CERP process can be found on the Air District's website.

Additional analyses may also provide more clues and context on possible causes of different levels of $PM_{2.5}$ in the measurement data and will be considered for future updates and to support the CERP process. Additional information on the Air District's air toxics monitoring project is also expected in the next update as that project gets underway.