

Air Monitoring Data

Review of air monitoring data for Bayview Hunters Point



**BAY AREA AIR QUALITY
MANAGEMENT DISTRICT**

DRAFT Report, August 2022

Key Takeaways from Available Air Monitoring Data

- Long-term trends show that levels at the San Francisco monitoring site at Arkansas St. and 16th St. are similar to or higher than levels at monitoring sites located within or nearby other communities experiencing disproportionate impacts from air pollution.
- The long-term PM_{2.5} trends from 2012-2021 also show that there has been less overall improvement in recent years.
- While PM_{2.5} levels are below the National Ambient Air Quality Standards (NAAQS), we know the PM_{2.5} NAAQS are not health protective, especially for populations experiencing cumulative impacts. Therefore, reducing the concentrations of PM_{2.5} further is warranted.
- Air District expects that pollutant concentrations, especially over short time periods, could be higher at times within Bayview Hunters Point than those measured at the San Francisco monitoring site and those elevated concentrations may vary significantly from place-to-place depending on proximity to nearby sources and the wind speed and direction.
- A review of the data shows that elevated levels of PM_{2.5} can occur throughout the year.
- There are multiple different types of meteorological patterns (wind speed, wind direction, inversions, etc.) that occur throughout the year that can affect which sources of air pollution contribute to elevated levels of PM_{2.5} in different places.
- Levels of Volatile Organic Compounds (VOCs) are similar compared to regional averages, except for two compounds (Ethyl Alcohol and Methylene Ketone), which are slightly higher than other sites in the Bay Area.
- Data from additional sources (previous short-term monitoring studies, Aclima) highlight the potential for short-duration or intermittent elevated concentration levels of PM_{2.5}, NO₂, and VOCs that may occur at different locations throughout the community during different times of the year.

Summary

A review of the available air monitoring data confirms that there is community exposure to air pollutants that is likely exacerbated by emissions from sources within the community and that these impacts affect the health of people living and spending time in Bayview Hunters Point. The existing air monitoring data supports the development of a Community Emission Reduction Plan to reduce emissions and exposure to all sources of air pollution, especially considering the additional cumulative impacts the community experiences from nearby sources (commercial, utility, industrial, mobile, etc.). The Air District also acknowledges that air monitoring data cannot by itself completely characterize the extent of air pollution issues within Bayview Hunters Point and a multi-faceted approach is needed - most important of which is the lived experience of Bayview Hunters Point community members.

Overview of Air District Monitoring

One type of information about air pollution in Eastern San Francisco is the monitoring data collected by the Air District's long-term air monitoring site. In general, these long-term monitoring sites are designed to reflect a typical population exposure and source mix for the area using approved methods and operations, according to U.S. EPA monitoring requirements. As such, they produce reliable data that is helpful for tracking the levels of the measured air pollutants through time at the one location. While these data provide some estimates of the air quality in Eastern San Francisco, they do not represent actual concentrations within Bayview Hunters Point and cannot provide a complete picture on their own about the air pollution community members experience on a regular basis.

The Air District has operated an ambient air monitoring site in Eastern San Francisco on Arkansas St. and 16th St. since January 1986. Instruments at the San Francisco monitoring site currently measure concentrations of ozone, nitrogen oxides, carbon monoxide, coarse particulate matter (PM₁₀), fine particulate matter (PM_{2.5}), and volatile organic compounds (VOCs). The Air District's 2022 Ambient Air Monitoring Network Plan¹ provides more information about the instruments currently deployed at the San Francisco monitoring site. The San Francisco monitoring site is located approximately 1.5 miles north of the Bayview Hunters Point neighborhood.

Due to the proximity and mix of sources located near and within Bayview Hunters Point, there are likely locations that at times experience higher concentrations than those measured at the San Francisco monitoring site; especially for air pollutants that have near-source impacts like PM, nitrogen oxides, black carbon, or VOCs.

¹ Bay Area Air Quality Management District, [2022 Annual Air Monitoring Network Plan](#), July 1, 2022

PM_{2.5} and Nitrogen Dioxide Trends.

EPA is required to set NAAQS for six common air pollutants (also known as “criteria pollutants”). The six criteria pollutants include particulate matter, ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.² For Bayview Hunters Point and other communities experiencing disproportionate impacts, PM_{2.5} and nitrogen dioxide (NO₂) are two of the criteria pollutants that are expected to have localized impacts. Comparing levels of these pollutants to EPA’s health-based NAAQS is one way to describe an area’s air quality in terms of health impacts. Long-term design value trends can generally inform typical area-wide air quality and track how data is changing compared to the NAAQS, but do not characterize times when concentrations may be higher at different locations under different conditions or for shorter amounts of time.

Also, the current levels of the PM_{2.5} NAAQS are not health protective, and reductions in PM_{2.5} concentrations at levels below the NAAQS have been shown to have health benefits.

Table 1 shows that the concentration levels of PM_{2.5} and nitrogen dioxide measured at the Arkansas St. monitoring site are below the applicable NAAQS level. Comparing an area’s air quality to the NAAQS uses a statistic derived from hourly or daily measurements and is called a design value.³

San Francisco PM_{2.5} and NO₂ Trends

Design values at the San Francisco monitoring site are equal to or higher than levels at monitoring sites located within or nearby other communities experiencing disproportionate impacts from air pollution. The long-term PM_{2.5} trends also show that there has been less overall improvement in recent years.

Table 1 - San Francisco 2019-2021 Design Values

Pollutant	NAAQS	Level of the NAAQS	Design Value
PM _{2.5}	2012 Annual	12 µg/m ³	8.5 µg/m ³
	2006 24-Hour	35 µg/m ³	25 µg/m ³
Nitrogen Dioxide	2010 1-Hour	100 ppb	42 ppb
	1971 Annual	53 ppb	8 ppb

Notes:

(1) µg/m³: micrograms per cubic meter

(2) ppb: parts per billion

Figures 1 through 3 show the 10-year design value trends at Air District monitoring sites from 2012-2021 and highlight how the design values for these pollutants can change from year-to-year. These variations are caused primarily by changes in both meteorology and emissions of air pollutants (natural and man-made). For example, PM_{2.5} design values are higher for years that have

² Additional information on criteria pollutants can be found on EPA’s website: <https://www.epa.gov/criteria-air-pollutants>.

³ The design value statistic for the form of a NAAQS for a pollutant is defined in [40 CFR Part 50](https://www.ecfr.gov/current/title-40-chapter-I-subchapter-B-part-50). More information about design values can be found on EPA’s website: <https://www.epa.gov/air-trends/air-quality-design-values>.

fewer winter storms due to increased rain and windy conditions that “clean out” air masses throughout the Bay Area. In recent years, wildfire smoke has caused the area to experience extremely high 24-hour PM_{2.5} concentrations leading to design values above the NAAQS for several consecutive years.

Figure 1 - PM_{2.5} Annual Design Values

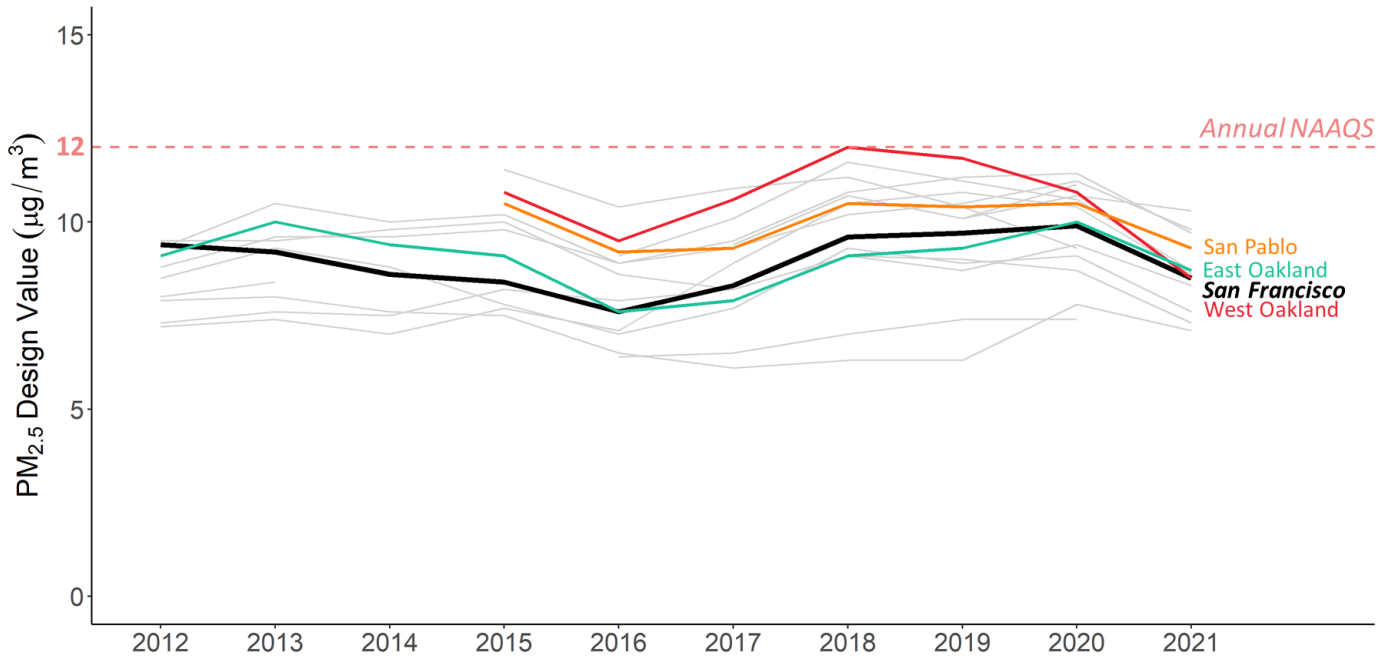


Figure 2 - PM_{2.5} 24-Hour Design Values

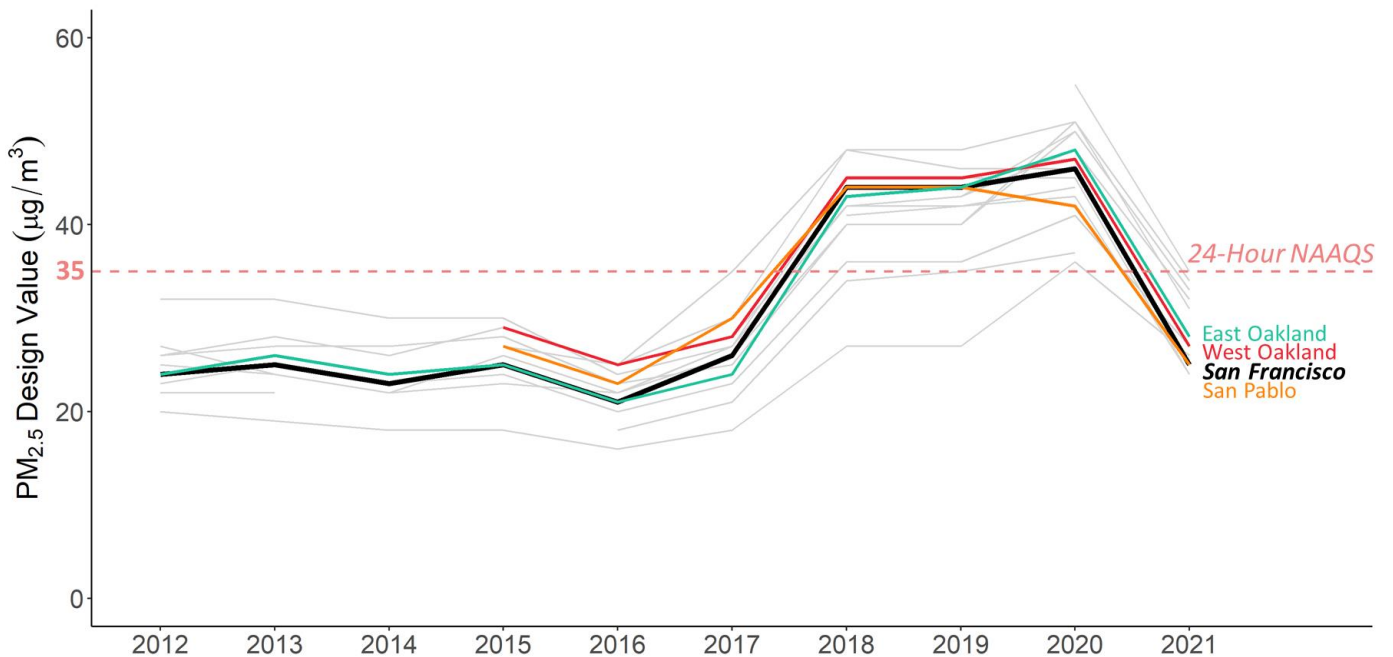
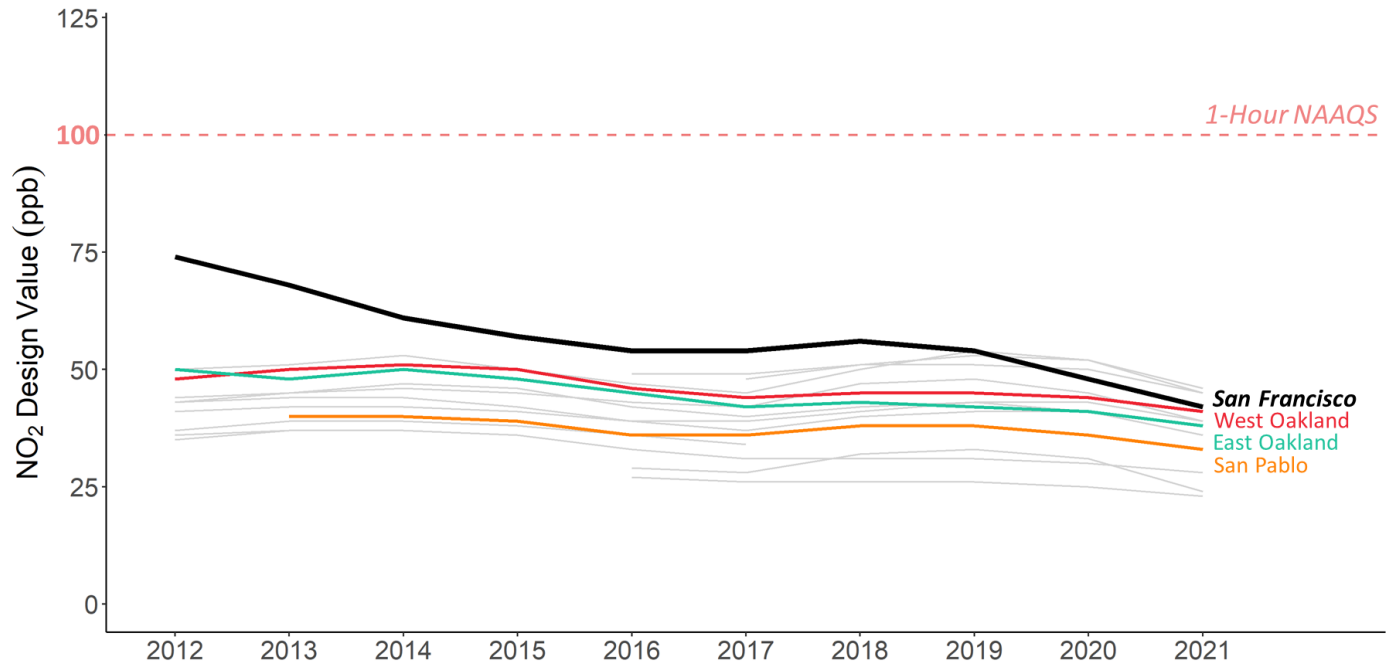


Figure 3 - Nitrogen Dioxide 1-Hour Design Values



Daily PM_{2.5} Values

Comparing the daily values can provide insights into what times of year experience higher concentrations. Reviewing seasonal patterns in the daily data can help to determine which sources may be contributing to elevated values at a particular location during different times of the year. Understanding day-to-day variations in these data are also important for assessing potential exposure to air pollution. There is no safe level of PM, so any increase in PM is an increase in exposure so it is important to characterize those events even if those concentrations are below the NAAQS.

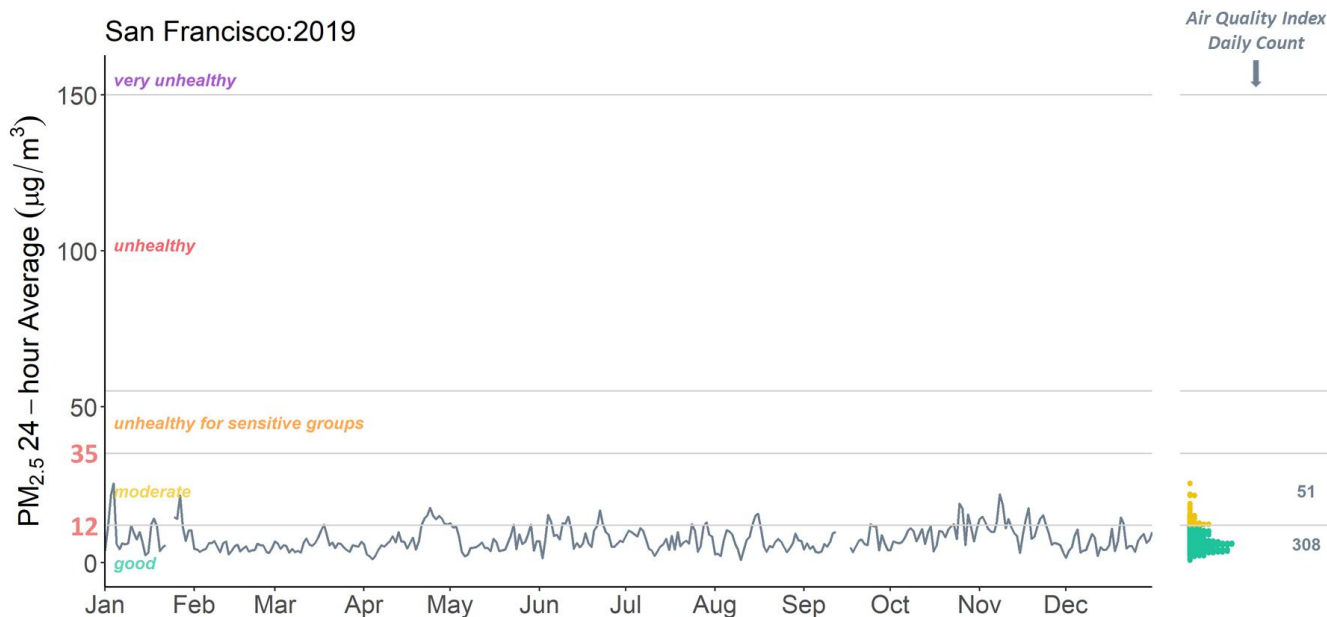
San Francisco Daily PM_{2.5} Values

There are multiple different meteorological patterns that occur throughout the year that can affect which sources of air pollution contribute to elevated levels of PM_{2.5} in different places. The highest concentrations occur in the fall and winter months when calm or light winds and inversions can trap pollutants close to the ground and cause PM_{2.5} to increase over several days at a time. This is also the time of year when winds from the East and Northeast can transport emissions from upwind areas during this time of year (sources on Amador St., Navy Shipyard, etc.). Elevated concentrations also occur during spring and summer months when winds from the West can transport emissions from upwind areas (U.S. 101, I-280, mixed industrial activities west of 3rd St, Sewage Treatment Plant, etc.). Strong winds from the West and North can also cause windblown dust emissions from sources including construction sites, vacant lots, or roadways. (see *Figure C, Additional Figures*) The daily values also show the extremely high PM_{2.5} concentrations caused by wildfires in August, September, and October 2020.

Figures 7 through 9 show the daily 24-hour average PM_{2.5} concentration values measured in the last three years and include the break points and total daily counts for the Air Quality Index (AQI) bins of good, moderate, unhealthy for sensitive groups, unhealthy, and very unhealthy air quality.

As stated before, the Air District expects that pollutant concentrations, especially during short-duration episodic events, could be higher within Bayview Hunters Point than those measured at the San Francisco monitoring site and those concentrations may vary significantly from place-to-place within Bayview Hunters Point depending on proximity to nearby sources and meteorology.

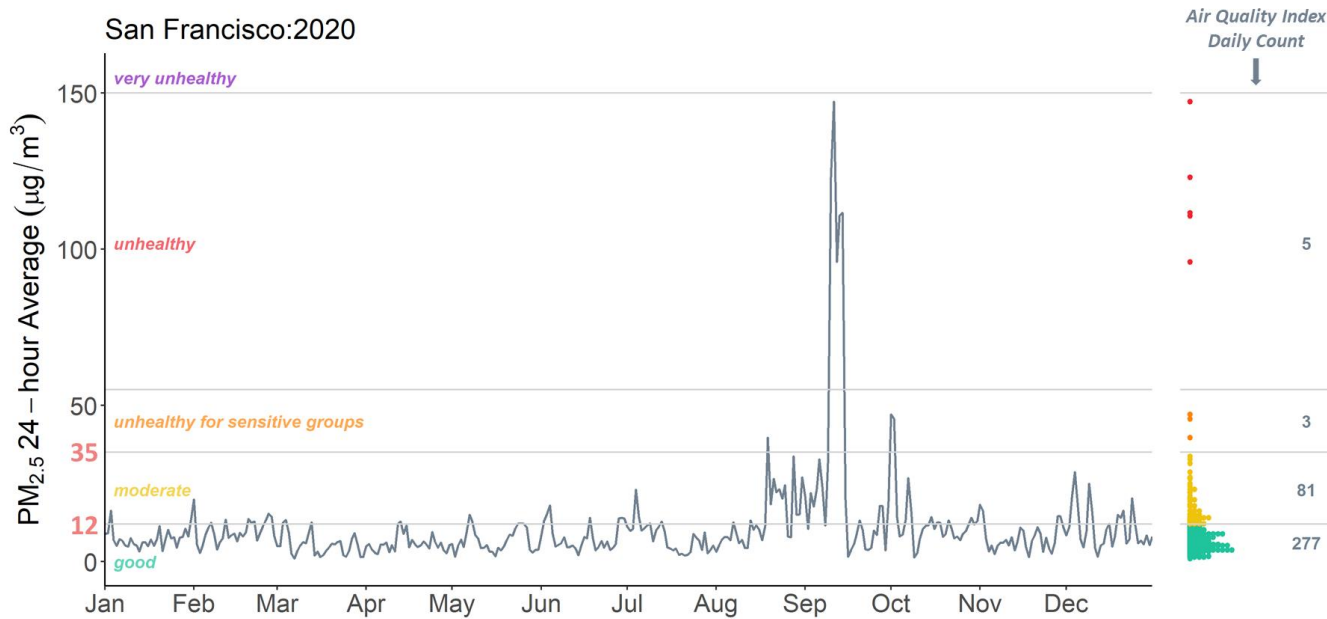
Figure 7 - PM_{2.5} Daily Values - 2019



Notes:

- (1) The breakpoint for the moderate PM_{2.5} AQI category corresponds to the level of the Annual PM_{2.5} NAAQS and is identified on the y-axis as 12 µg/m³
- (2) Similarly, the breakpoint for the unhealthy for sensitive groups PM_{2.5} AQI category corresponds to the level of the 24-hour PM_{2.5} NAAQS and is identified on the y-axis as 35 µg/m³

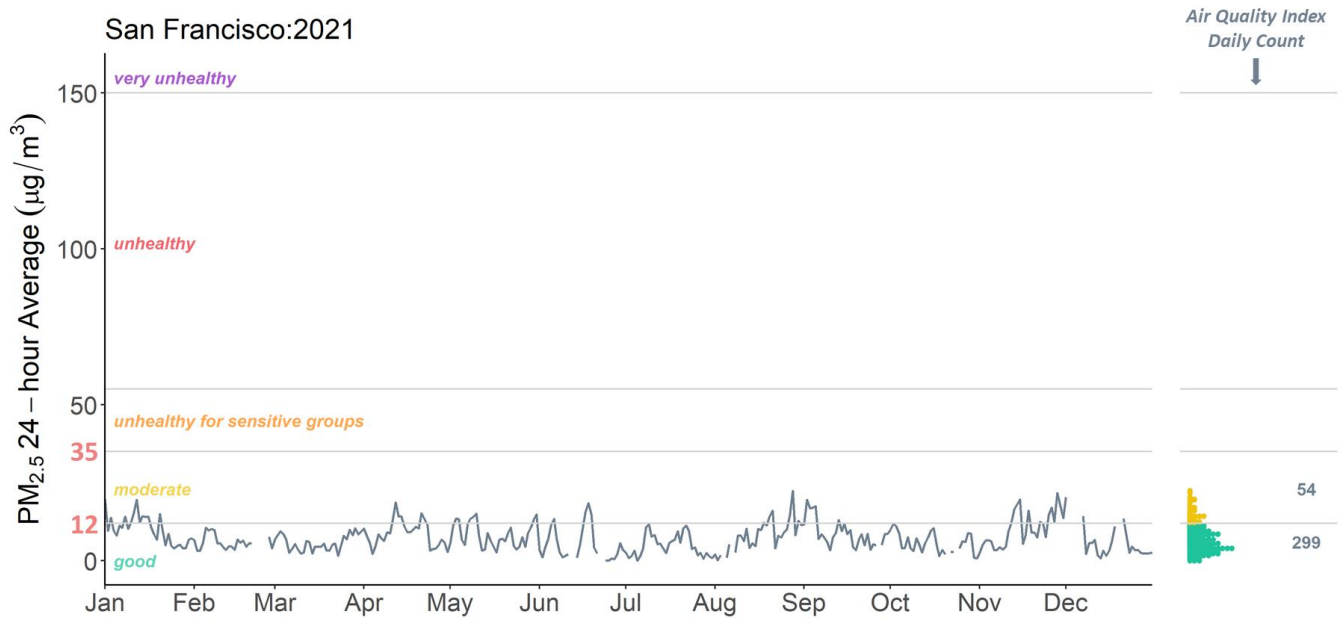
Figure 8 - PM_{2.5} Daily Values - 2020



Notes:

- (1) The breakpoint for the moderate PM_{2.5} AQI category corresponds to the level of the Annual PM_{2.5} NAAQS and is identified on the y-axis as 12 µg/m³
- (2) Similarly, the breakpoint for the unhealthy for sensitive groups PM_{2.5} AQI category corresponds to the level of the 24-hour PM_{2.5} NAAQS and is identified on the y-axis as 35 µg/m³

Figure 9 - PM_{2.5} Daily Values - 2021



Notes:

- (1) The breakpoint for the moderate PM_{2.5} AQI category corresponds to the level of the Annual PM_{2.5} NAAQS and is identified on the y-axis as 12 $\mu\text{g}/\text{m}^3$
- (2) Similarly, the breakpoint for the unhealthy for sensitive groups PM_{2.5} AQI category corresponds to the level of the 24-hour PM_{2.5} NAAQS and is identified on the y-axis as 35 $\mu\text{g}/\text{m}^3$

Volatile Organic Compounds

Levels of volatile organic compounds (VOCs) in the air, many of which are also air toxics, are measured by collecting air into a canister over 24 hours, and then analyzing the air mixture at the Air District Laboratory.

San Francisco VOC Comparison

For two compounds, Ethyl Alcohol and Methylethylketone, the mean concentrations measured at the San Francisco monitoring site from 2017-2021 are slightly higher than the network-wide mean concentrations, but they are below OEHHA's chronic and acute reference exposure levels (RELs).⁴ Ethyl Alcohol is a fuel additive and used as a solvent. Methylethylketone is used as a solvent and found in coatings and resins.

Table 2 lists the maximum and mean 24-hour concentrations of the VOCs measured at the San Francisco monitoring site from 2017-2021 compared to the concentrations measured at all the other Air District monitoring sites.

Table 2 - San Francisco 24-hour VOC Concentrations from 2016-2021

Pollutant	San Francisco Concentrations (ppb)		Network-Wide Concentrations (ppb)	
	Mean	Maximum	Mean	Maximum
Acetone	4.136	13.562	4.951	86.933
1-3-Butadiene	0.005	0.126	0.006	0.541
Benzene	0.139	1.390	0.166	3.123
Carbon Tetrachloride	0.103	0.126	0.104	0.984
Chloroform	0.011	0.057	0.014	0.135
Dichloromethane	0.070	0.317	0.084	5.750
Ethyl Alcohol	4.943	40.469	3.654	91.740
Ethylbenzene	0.070	0.372	0.077	1.201
Freon-13	0.066	0.083	0.066	0.235
Methyl Chloroform	0.000	0.000	0.007	1.266
Methylethylketone	0.244	1.075	0.231	5.743
Toluene	0.296	1.193	0.364	3.925
Trichlorofluoromethane	0.229	0.275	0.235	0.673
m/p-Xylene	0.155	0.640	0.174	3.154
o-Xylene	0.058	0.302	0.070	1.446

Notes:

(1) $\mu\text{g}/\text{m}^3$: micrograms per cubic meter

(2) San Francisco mean values that are greater than the regional mean have been **highlighted**

⁴Office of Environmental Health Hazard Assessment, OEHHA Acute, 8-hour and Chronic Reference Exposure Level Summary, November 4, 2019.

Similar to discussions about PM_{2.5}, data from the Air District long-term air monitoring sites do not fully explain the range of VOC and air toxics impacts that we expect throughout Bayview Hunters Point due to the complex mix of air pollution sources in close proximity to where people live or spend time throughout the day. Often these near-source impacts are localized and can occur intermittently in different locations and/or for a short amount of time. These types of air pollution episodes may not be well characterized by the Air District's long-term regulatory air monitoring sites.

Also, while the science is still evolving, there are not currently many health-based thresholds for concentrations measured at shorter durations . However, these higher air pollution levels that happen over shorter time periods or at places without a monitor still affect the community, even though they may not result in an 8-hour, 24-hour, or annual average level above the NAAQS or a REL.

Additional Air Monitoring Data

In addition to the Air District long-term monitoring sites, other air monitoring approaches can help to provide a more complete picture of the levels of air pollution experienced by the community.

Additional Air Monitoring Data

These data highlight the potential for short-duration or intermittent elevated concentration levels of PM_{2.5}, NO₂, and VOCs that may occur at different locations throughout the community during different times of the year.

Table 3 lists several air monitoring studies that were conducted to assess concentration levels of various pollutants within Bayview Hunters Point.

Table 3 - Additional Air Monitoring Data Available in Bayview Hunters Point

Source of Data	Timeframe of Measurements	Pollutants
Hidden Hazards of Bayview Hunters Point, Appendix J: Preliminary Investigation of Air Pollution in San Francisco's Hunters Point Region	1998	VOCs
Hidden Hazards of Bayview Hunters Point, Appendix I: Determination of Volatile Organic Compounds in Bayview Hunters Point	April 2018 - April 2019	VOCs
State of the Air in Bayview Hunters Point: Results of the Bayview Community Air Monitoring Project (BayCAMP)	June 2004 - June 2005	VOCs, PAHs, Hexavalent Chromium, Non-Methane Hydrocarbons, PM _{2.5} , SO ₂ , CO, NO, NO ₂ , O ₃
Aclima: San Francisco Annual Baseline ⁵	October 2019 - September 2020	PM _{2.5} , NO ₂ , O ₃ , CO, CO ₂
Greenaction for Health and Environmental Justice: CARB Community Air Grant ⁶	April 2021 - Present	PM _{2.5} , PM ₁₀
Publicly Available Sensor Networks: PurpleAir, Clarity	Present	PM _{2.5} , NO ₂

Notes:

(1) Previously undefined terms include: Polynuclear Aromatic Compounds (PAHs), Sulfur Dioxide (SO₂), Carbon Monoxide (CO), Nitrogen Oxide (NO)

The measurements included in the Hidden Hazards of Bayview Hunters Point report show short-duration elevated levels of VOCs in localized areas of the community; including near schools and known sources of VOCs such as autobody shops and the San Francisco Southeast Treatment Plant.

⁵ Aclima San Francisco Baseline; <https://air.health/bayarea?contract=san-francisco&pollutant=no2>

⁶ Greenaction for Health and Environmental Justice IVAN Air Monitoring Network; <https://www.bvhp-ivan.org/air>

The BayCAMP study shows that the acute (Acute Health Index) and chronic (Chronic Health Index) health risks from the pollutants measured during the study were higher at the BayCAMP monitoring site compared to the San Francisco monitoring site. The report also shows that 24-hour PM_{2.5} concentrations were also higher when compared to the San Francisco monitoring site, especially during higher PM_{2.5} days in the winter months. Since the BayCAMP monitoring site was located near Hilltop Park at the Earl P. Mills Community center and further away from emission sources, concentrations could likely be higher at different locations throughout Bayview Hunters Point that are closer to nearby sources. The Air District also notes that these data were collected 18 years ago and the composition of sources of air pollution within Bayview Hunters Point may be different today.

More recently, Aclima collected mobile measurements of various pollutants throughout San Francisco County by repeatedly driving road segments to estimate annual averages of those pollutants on a block-by-block level. These data were later aggregated into hexagon areas that cover approximately a square quarter mile by averaging all the data collected on road segments within a particular hexagon.

PM_{2.5} and NO₂ hexagon values are both comparatively higher at locations near major roadways (I-280 and U.S.-101) and locations near Amador St. Higher areas of PM_{2.5} are found more consistently throughout Bayview Hunters Point. Maximum PM_{2.5} road segment values were observed on Carroll Ave. between Ingalls St. and Arelious Walker Dr., Amador St., Carroll Ave./3rd St., and Underwood Ave/Ingalls St.

Future Data Analysis

This assessment of the data represents the current analysis completed by the Air District, but we continue to evaluate these data and will update this assessment as additional analysis are made.

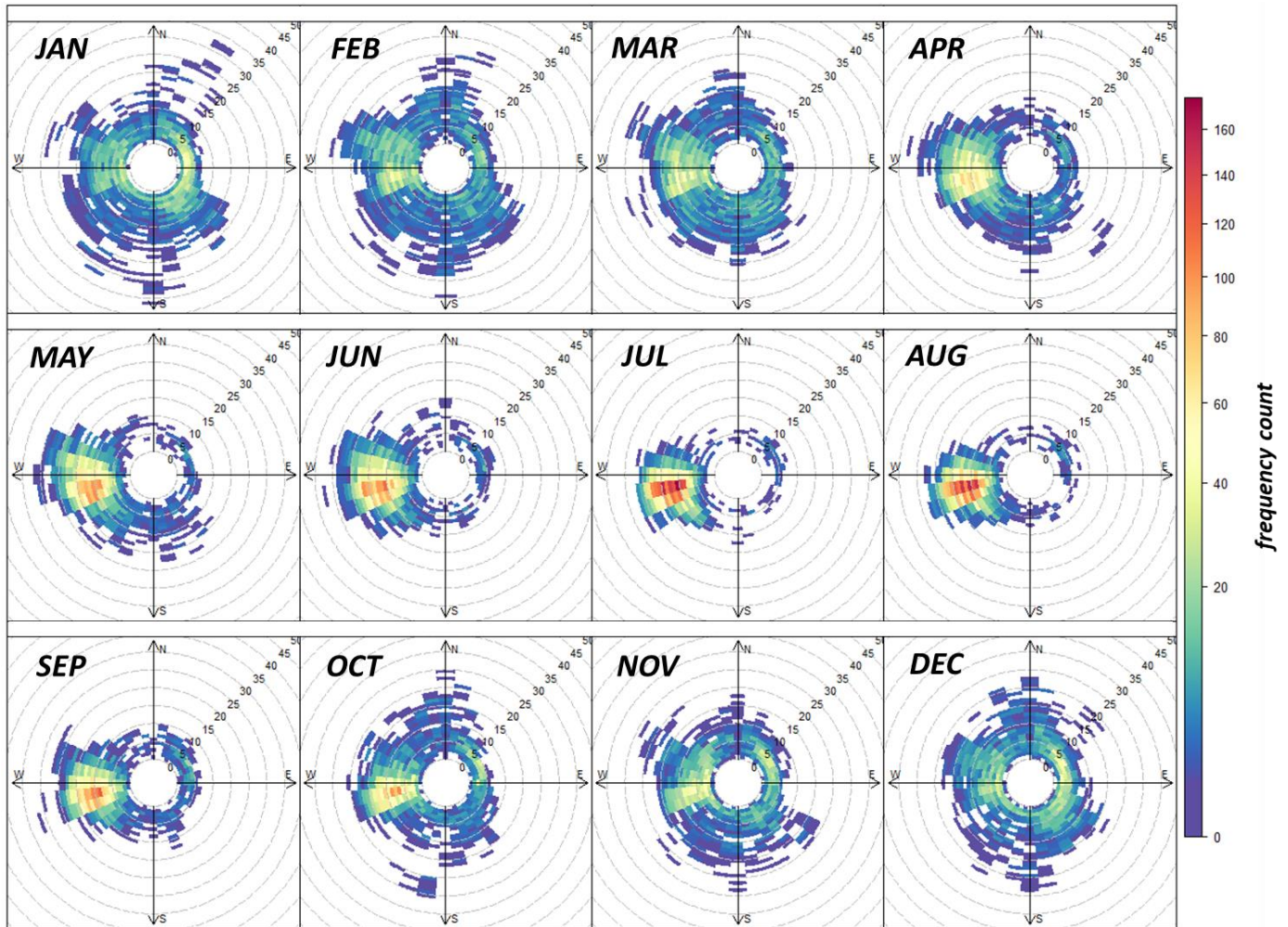
Future analysis may include:

- A review of PM₁₀ data collected at the San Francisco air monitoring site.
- Evaluation of segment-level Aclima data for San Francisco.
- Historical data analysis and ongoing monthly reports of data collected by Greenaction.
 - The Bay Air Center, which is a third-party technical support contract managed by the Air District, is currently reviewing these data, and will be conducting future and ongoing analyses.
- A review and analysis of other publicly available sensor network data including data from PurpleAir and/or Clarity sensors located within Bayview Hunters Point

Additional Figures

Figure C shows hourly wind speed and wind direction plots from the San Francisco Sewage Treatment Plant separated by month to show the different types of meteorological conditions that occur throughout the year.

Figure C - Hourly Wind Speed and Direction Frequency Plots



Notes:

- (1) Wind directions are binned and counted in 30° increments at each wind speed, which increases from the center of the plot outward and are noted in the hashed circles and the diagonal numbers.
- (2) The counts are then colored from higher to lower and provide a visual as to which wind speed and direction combinations are more frequent in each month.