Real-Time Air Quality Data Sources in the Bay Area

Introduction

The Bay Area is served by multiple complementary air monitoring networks, including a regulatory network maintained by the Bay Area Air District fulfilling U.S. EPA requirements for consistent and long-term monitoring of air pollutants, as well as networks of thousands of fine particulate matter, or $PM_{2.5}$, air sensors deployed by community-based organizations and members of the public that provide real-time measurements at more locations than the regulatory network.

This document provides an overview of sources of real-time air quality data in the Bay Area, with a focus on $PM_{2.5}$ and ozone as pollutants of concern for public health, to aid community members in finding appropriate data for their use.

Regulatory monitors

The Air District's 30+ regulatory air monitoring stations provide the most accurate information on regional air pollution. Data from air monitors at these stations are validated according to rigorous quality control and quality assurance requirements from the U.S. EPA to ensure that the data is consistent and accurate. These data are also used to determine if the Bay Area meets state and federal air quality standards for a wide range of pollutants, including $PM_{2.5}$ and ozone.

The regulatory air monitoring stations are sited following specific requirements established under federal regulations, which are primarily driven by population and levels of pollution as well as meteorology and wind patterns, topography, and nearby pollution sources.

Air sensors

$PM_{2.5}$ sensors now greatly outnumber regulatory monitors in the Bay Area. This dense network provides local-scale, real-time information about levels of fine particulate matter.

$PM_{2.5}$ is typically the only pollutant measured by air sensors. Other air pollutants that are relevant to public health are not measured by most sensors, with some exceptions.

AirNow has incorporated publicly available data from these $PM_{2.5}$ sensors into the AirNow Fire and Smoke map to augment information from the regulatory network. This is the best way to view real-time data from air sensors together with other contextual information about current air quality, especially during wildfires. PurpleAir and Clarity also provide their own maps of $PM_{2.5}$ sensors deployed by community-based organizations or members of the public.

Air sensors are useful for understanding how air quality is changing throughout a neighborhood (for example, *are concentrations increasing or decreasing?*). They can also be used to qualitatively track how levels of pollution vary from place to place during events such as wildfires (for example, *is my neighborhood being impacted by wildfire smoke?*).

However, readings from air sensors often differ from nearby regulatory monitors and should be viewed cautiously due to the following reasons:

- Air sensors can be subject to interference unrelated to air quality that may impact readings (fog, relative humidity, temperature, etc.).
- Air sensors may be placed in a location that is only representative of a very small area (under an outside awning or near pollution sources such as roadways, cooking devices, cigarette smoke) or may not be appropriately maintained, which adds to the uncertainty when interpreting this data.
- Various websites that display air sensor data could use different corrections or methodologies to adjust the data, leading to differences in reported values from the same measurement.
- Accuracy of $PM_{2.5}$ measurements from different emissions sources may vary (for example, wildfire smoke vs. typical urban $PM_{2.5}$ pollution).

For these reasons, data from air sensors should be considered with other supporting information, including the Air District's air monitoring data. Further information about PurpleAir and Clarity sensor data can be found at the PurpleAir FAQ and the Clarity blog.

Where to find general information on air quality in the Bay Area

- The AirNow Current Air Quality, Air Quality Forecast and Fire and Smoke Map are the best sources for air quality information in the Bay Area. The Current Air Quality and Air Quality Forecast website provides information on current conditions and forecasts for $PM_{2.5}$ and ozone from the Air District regulatory

monitoring network and meteorologists. The Fire and Smoke Map includes additional $PM_{2.5}$ measurements from air sensors but does not include ozone measurements or air quality forecasts.
- AirNow includes information from the Air District's regulatory air monitoring network. Data from individual Air District monitors are on the AirNow interactive map and the Air District website.

Where to find information on rapidly changing air quality

- The AirNow Fire and Smoke Map provides real-time information on $PM_{2.5}$ concentrations from regulatory air monitors, air sensors, temporary monitors deployed by other government agencies, and satellite-detected smoke plumes. The map's user guide contains helpful information on how to understand and use the map.
- The Air District's Wildfire Safety webpage offers resources on how to prepare for, track, and respond to wildfire smoke. Additional information on wildfire smoke and public health is available on the California Air Resources Board Smoke Ready California and the U.S. EPA Wildland Fires and Smoke webpages.

Interpreting the Air Quality Index

The Air Quality Index, or AQI, is a tool developed by the U.S. EPA to communicate about air quality and public health. The AQI is only available for the five pollutants regulated by the Clean Air Act, but typically just $PM_{2.5}$ and ozone are reported since those are often the pollutants with the highest concern for public health.

In most cases, the federal standard for these air pollutants corresponds to the number 100 on the AQI. For example, the PM2.5 AQI value is 100 when the 24-hour average concentration is 35 micrograms per cubic meter.

- When the Air District prepares its daily forecast, we take the anticipated 24-hour concentration measurements for each of the major pollutants, convert them into AQI numbers, and post the highest AQI number for each reporting zone. The AQI values for each pollutant are not combined. For example, the values for $PM_{2.5}$ do not include ozone data.
- The U.S. EPA uses the NowCast methodology to estimate the AQI at a given point in time. Since the AQI for $PM_{2.5}$ applies to a 24-hour average, the NowCast is needed to estimate the current AQI using data from the current hour and multiple past hours. Data on the Air District website, the AirNow website, and the

U.S. EPA's Fire and Smoke Map apply this calculation when showing the latest hour's AQI.

- On October 1, 2025, the Air District updated its Wood Burning Rule, lowering the Spare the Air Alert threshold from a daily forecast level of 35 to 25 micrograms per cubic meter of fine particulate matter.
- Lowering the Spare the Air Alert threshold ensures alerts are called earlier, before pollution builds up, protecting children, seniors, and vulnerable residents. This means alerts will occur more often when air quality is in the mid-moderate range or above on the AQI, since $PM_{2.5}$ at these levels can still harm our health.

More details about the AQI are available on the AirNow AQI Basics web page.

AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Source: www.airnow.gov/aqi/aqi-basics

Frequently Asked Questions About $PM_{2.5}$ Data

Which site is the most accurate, and what is the best resource for $PM_{2.5}$ data?

The Air District's network of air monitoring sites provides the most accurate $PM_{2.5}$ measurements available. It includes data from our 17 regulatory $PM_{2.5}$ monitors, which are sited based on specific U.S. EPA requirements driven by population density,

meteorology, topography, and nearby pollution sources, and is operated and maintained consistently.

Air District $PM_{2.5}$ monitors collect a sample for 50 to 52 minutes, which is then analyzed for eight minutes. Preliminary data quality checks are then performed before it is shown on the website. The AirNow Current Air Quality, Air Quality Forecast, and Fire and Smoke Map are the best sources for air quality information during common events such as high $PM_{2.5}$ concentrations in the winter or during wildfires.

Although the exact level of air pollution shown might not be as accurate from air sensors, the density of data means they can provide more information about how air quality is changing in real-time on a neighborhood-by-neighborhood basis, which is particularly useful during wildfire smoke events. Air sensor data is refreshed more often than regulatory monitoring data, and there are a larger number of sensors than regulatory monitors in the Bay Area.

The AirNow Fire and Smoke Map displays hourly $PM_{2.5}$ data nationally from stationary and temporary monitors deployed by regulatory agencies, as well as low-cost sensors from PurpleAir and Clarity. The sensor data is adjusted by an algorithm that compensates for some of the inaccuracies of these sensors. Data are updated hourly, and the map has the highest density of data points due to the additional data from the air sensors, which fills in the geographic gaps between regulatory monitors. This map can be particularly helpful since it displays data from Air District regulatory monitors, California Air Resources Board temporary monitors, and PurpleAir sensors on one map. However, the other websites can be useful backup resources under certain circumstances.

Some air sensor manufacturers provide their own maps that show air quality readings from all publicly available sensors. The PurpleAir map only shows data from PurpleAir sensors and readings are averaged over 10 minutes by default. This map gives the option to select different time averages or data correction factors. Similarly, the Clarity OpenMap shows hourly average data from Clarity sensors, but with different data processing and additional calculations to compensate for inaccuracies in the sensors. The Clarity OpenMap also uses the same conversion from pollutant concentration to AQI as the Air District and AirNow. Data are collected on five- to 15-minute intervals, and a site-specific correction factor is used to adjust the data before it is posted to the OpenMap on an hourly basis.

In summary, Air District data available on AirNow are most accurate, but sensor data can provide important information about rapidly changing air quality and provide insight on neighborhood-to-neighborhood changes in $PM_{2.5}$ concentrations. During smoke events, the AirNow Fire and Smoke Map is the best resource because it combines information from both regulatory monitors and air sensors.

What determines the location of Air District air quality monitors, and why isn't the network more dense?

The Air District operates 17 regulatory $PM_{2.5}$ monitors, which are sited based on specific U.S. EPA requirements driven by population density, meteorology, topography, and nearby pollution sources, and are operated and maintained consistently. Due to the cost of maintaining regulatory-grade air monitors, the network is not as dense as that of low-cost air sensors.

Why isn't there a Spare the Air Alert in effect when the PurpleAir map is red?

The Air District reviews data from PurpleAir sensors when issuing air quality forecasts and Spare the Air Alerts, but measurements from these sensors may vary from those from regulatory monitors for a variety of reasons related to the factors described in the “air sensors” section above. The PurpleAir map also defaults to 10-minute averages, which is a shorter averaging time than the forecasted 24-hour average AQI that is used to issue Spare the Air Alerts. Due to more rapid changes in air quality at these shorter averaging times, there may be periods of the day when the PurpleAir map does not match the forecasted 24-hour AQI.