NORTHERN SONOMA COUNTY AIR POLLUTION CONTROL DISTRICT
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NoSoCoAir Guidelines for Online Monitoring Resources

Introduction

Ideally, air quality monitors would be inexpensive, accurate, easy to deploy and operate, and we could site and deploy as many as we needed. However, this is not yet the case. For the most part, the most reliably accurate monitors are stationary, expensive to maintain and operate, and the measurement instrumentation is delicate and expensive. These certified, accurate monitors are typically regulatory monitors operated by air districts and other government agencies and can be used in rule-making and planning.

Advances in technology are bringing us a new era of personal monitors or sensors which are substantially cheaper to purchase and operate than regulatory monitors ($225 vs. $75,000), but are not capable of the accuracy required to replace regulatory monitors. However; these new sensors have decent accuracy and can be useful tools to complement regulatory monitors when we understand their use and limitations. An emerging, popular sensor is by the brand "PurpleAir."

Data Look Different on Different Sites

Residents of the District have been noticing that different online sources have different values for the same area. For example:

"I'm seeing dramatically different readings between NoSoCoAir and PurpleAir. Any idea why? PurpleAir is reading in the high 100s in the lower River (193 Guernewood, 177 west of Monte Rio, 198 Old Caz)... AQNow has Guerneville at 60. Any thoughts? "

The answer is that the data sets are measuring and displaying different data: PM-10 vs PM-2.5, so the values will (correctly) not align. PurpleAir measures PM-2.5 or fine Particulate Matter (PM), but has accuracy limitations, notably at upper bounds. The District network is the most accurate, but only for PM-10 or coarse PM, which comprises ash, a smaller fraction of wildfire smoke. "AirNow Current AQI" (AQI = Air Quality Index) is a regional modeling tool with statistically-derived PM-2.5 values, and "AirNow Fire" is measured PM-2.5 values for a limited number of sites. AirNow gets its data from certified regulatory government monitors, and its "AirNow Fire" page is the most accurate for viewing actual monitor readings; however, there may be a time lag of around two hours during rapidly changing conditions, because of the frequency with which the monitors can update the website.

How to Use Online Resources

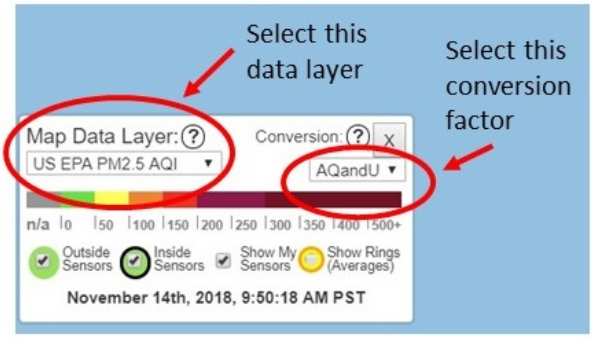
It is important to use online resources in a complimentary way, recognizing that they are meant to do different things and therefore will have different values. To assess air quality during wildfire or emergency conditions, the District recommends reviewing websites in the following order:

1. AirNow Fire. Available as a link off of the main AirNow home page, the AirNow Fire map is the most accurate source available for PM-2.5 measurements, but the number and distribution of sites is limited and there may be a time lag.
2. PurpleAir. The PurpleAir sensors capture the fine particulate (PM-2.5) that is predominant in wildfire smoke and will provide the most cautious health-based numbers (higher numerical values). The PurpleAir network is most reliable when seen as a whole, with several sensor readings being reported at once, so general trends can be observed. PurpleAir sensors can be located indoors or outdoors; in order to assess outdoor air quality, be sure to view only outdoor sensors.
3. District Data. These data provide accurate measurements of PM-10 levels, a good indicator of ash concentrations during wildfire conditions. Also, the locations and values of the District PM-10 monitors can be used as an anchor when interpreting data from other sites (for example, observing how changes in PM-10 concentrations mirror changes in the PM-2.5 concentrations tracked elsewhere).
4. AirNow Current AQI (and Forecast). The main AirNow home page contains the "Current AQI" map and the "Forecast AQI" map, both of which extrapolate government monitoring data across the map. This tool is good for providing estimations of current and upcoming air quality using government certified air monitors.

The color coding indicated on the maps is the 'AQI' or Air Quality Index. This index, developed by the Environmental Protection Agency, defines different thresholds of air pollution concentrations based on their estimated impact upon human health, and gives general descriptions of health risk for each level. The District has developed its own recommendations based on AQI, in its chart of Recommendations for Outdoor Physical Activity During Smoky Conditions.

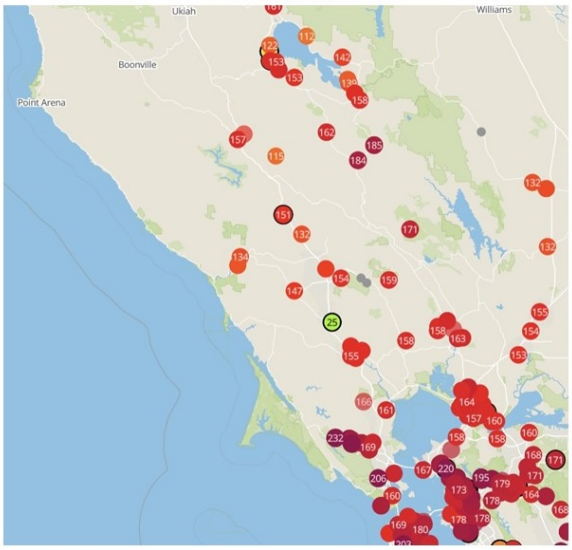
In-Depth Review of Online Resources

1. PurpleAir. PurpleAir sensors measure fine PM (PM-2.5), but they have limits in accuracy. They are shown in lab and field studies to correlate well with regulatory government monitors in low and moderate conditions, but the sensor hardware is known to overestimate in elevated PM conditions. There is a legend setting in the PurpleAir Map to help compensate for this. To view more accurate corrected AQI, set your PurpleAir map legend as shown in the graphic.



The advantage of the PurpleAir sensors is that they are inexpensive; therefore local and statewide coverage is growing rapidly, and there are enough data points to see trends in movement and over time. Another upside: data on the website refreshes at a near instant rate. The downside to PurpleAir is that you don't know if these personal monitors are being sited or maintained properly.

PurpleAir has the most sites and greatest distribution.



California Air Resources Board (CARB), and other air quality professionals, are of the mind that the PurpleAir sensors are good for emergency events, and they can indicate when government agencies such as air districts need to request CARB to bring in portable government-certified monitor during an emergency for areas where they don't have one. This actually did happen during this current incident, and CARB is establishing portable monitors for PM-2.5 for support.

2. District Monitors. The District monitors measure PM-10, so they are only recording the coarse PM. The District data is displayed via a product called "AirVision-Agilaire." Wildfires emit more fine than coarse PM, so PM-10 monitors do not provide a complete picture of wildfire impact. Thus, District/PM-10 monitors will measure lower values and display a more healthful AQI index/color than a PM-2.5 monitor during a wildfire event. The PM-10 monitors will measure ash from the fire, where the PM-2.5 monitors cannot.

   The PM-10 AQI is also a different scale from the PM-2.5 AQI. The logic behind this is that coarse PM-10 doesn't have the same health risk as fine particulate, so slightly elevated levels of PM-10 can pose a relatively low health risk, while the same concentrations of PM-2.5 are more harmful to human health. The advantage to the District monitors is that they have been properly sited to account for a true average ambient air quality; they are regularly maintained; they are routinely quality checked and audited for accuracy; and they are sophisticated, high end instruments designed to report accurate and precise values for regulatory and planning purposes.

   The District monitors only measure PM-10 because they were established before the PM-2.5 standard existed. The District is investigating whether the equipment can be retrofitted to measure PM-2.5 and still maintain their government classification. Typically, these types of accurate monitors are required to be sited at a density of at least one PM-2.5 monitor per county, placed near the most densely populated areas. For Sonoma County, the Bay Area Air Quality Management District has the bulk of the population and therefore they established the PM-2.5 monitor here. The Bay Area Air Quality Management District maintains this official county-wide PM-2.5 monitor site in Sebastopol.

3. AirNow. AirNow has multiple products available, notably "AirNow Current AQI," "AirNow Forecast," and "AirNow Fire." AirNow uses PM-2.5 data; therefore, the District's PM-10 monitor data won't correlate with AirNow values. "AirNow Current AQI" is a modeling tool that takes a few regulatory monitor point locations (such as the government-run PM-2.5 monitor in Sebastopol), and extrapolates their values out across broad areas that don't have monitors.

The colorful map visible on the AirNow site main page is simply an estimate and does not reflect actual measured AQI in all locations. The advantage to this is that it can help estimate air quality in areas that do not have monitors; but the disadvantage is that the reliability of the estimated AQI decreases with further distance from the monitor locations, and is less reliable in areas where there are a limited number of monitor points to estimate from.

"AirNow Forecast" is found by clicking the "forecast" tab on the main map; it provides a forecast of future AQI based on current conditions. The advantage is that it can be useful to get an idea of future conditions; the disadvantage is that, as with weather forecasts, the AQI forecast may not be accurate.

"AirNow Fire" is another feature on the AirNow site, and displays individual points of permanently-sited regulatory monitors (circle symbols on the map) and temporarily deployed monitors (triangles on the map). "AirNow Fire" displays PM-2.5 data from the most accurate certified instrumentation available. The disadvantage is the limited number of sites. Typically, AirNow displays one monitor point for Sonoma County; however, during the ongoing smoke incident 3 additional portable monitors are in the process of being deployed.

Only a few "AirNow Fire" sites for a large area.