Northern Sonoma County
Air Pollution Control District

AB 617 Community Air Protection Program
Grant Report

Grant # G17-CAPP-22 Amendment 1
And
G18-CAPP-22

Fiscal Grant Term: 2017-2018 and 2018-2019

Submitted to the California Air Resources Board on:
June 28, 2019

1. Contact Information

California Air Resources Board Project Liaison:

Andrea Juarez
California Air Resources Board
Office of Community Air Protection
9480 Telstar Ave.
El Monte, CA 91731
Phone: (626) 450-6158
E-Mail: andrea.juarez@arb.ca.gov

District Grant Liaison:

Jessica DePrimo
Northern Sonoma County Air Pollution Control District
150 Matheson Street
Healdsburg, CA 95448
Phone: 707-433-5911
E-Mail: Jessica.DePrimo@sonoma-county.org

2. Timeline

Work Task	Completed
Grant Agreement Execution	7/9/2018
District Resolution	6/6/2018
Deployment of Purple Air Units	11/23/2018
Analysis of Purple Air Results during Event	11/23/2018
Preparation of AQI Guidance Document, Web Resource Page	11/15/2018
Presentation at Meeting with SCOE and School Districts	12/5/2018
Assistance with Preparation of AQI Guidance for Schools	4/5/2019
Final Report	6/28/2019

3. Summary of Completed Tasks

The following summary describes the Northern Sonoma County Air Pollution Control District's ("District's") Community Air Protection implementation campaign for Grant

Numbers G17-CAPP-22 and G18-CAPP-22. The District was not selected by CARB for a community project, but it elected to devote its Community Air Protection (CAP) funds to a campaign that incorporates CAP categories. First, with the District's deployment of Purple Air sensors and analysis of those sensors, the District formalized its community-based air monitoring campaign. In addition, the District devoted CAP funds to community wildfire response, especially in the context of school response to wildfire smoke events. The District expects to experience more exposure in coming years due to increased incidence of wildfires in our area. Wildfire events are of great concern to our community, having been impacted by several smoke events over the last few years and especially having been physically impacted by wildfire during the Tubbs fire in 2017. The District recognizes the likelihood of wildfire events impacting our area in the years to come, with each event constituting a significant exposure burden. Though the District contains no designated low income or disadvantaged communities, this effort funded by Community Air Protection funds supports the health and well-being of some of our most vulnerable populations: school age children.

The District's CAP campaign incorporated the following tasks: deployment of Purple Air sensors; analysis and interpretation of Purple Air sensor data over time, indoor and outdoor, and in comparison with established Federal Equivalent Method (FEM) monitors during a wildfire event; communication and training of the public with regards to interpretation of air monitors and sensors via the AQI Guidance Document; collaboration with Sonoma County Office of Education (SCOE) and area school districts to share technical knowledge of air sensors and the air monitoring network; and assistance with preparation of local and statewide air quality guidelines for schools.

a) Deployment of Purple Air Units
   Between September 7 and November 23, 2018, the District deployed and installed eight Purple Air units to various areas throughout the district, as well as neighboring areas just south of the District boundary (Bay Area AQMD territory). Expanding the Purple Air network was one way the District contributed to its community air monitoring effort.

b) Analysis of Purple Air Results during Event
   Beginning on November 8, 2018 and through late November 2018, the Camp Fire caused significant smoke impacts in the District. Using its ambient air monitoring network, in addition to the network of Purple Air sensors it deployed and additional Purple Air sensors and an eBAM deployed during the event, the District gathered air quality data for analysis and was able to track reliability of Purple Air sensor data as compared to FEM air monitor data during this extreme wildfire smoke event. In addition, the district tracked indoor Purple Air readings in comparison with outdoor readings, and observed the difference recorded by its indoor Purple Air sensor when an indoor air purifier was introduced, thereby generating some real world data about the effectiveness of consumer grade indoor air purifiers. Results of these studies are shown in the presentation in Attachment 1, which the District presented at a Primary Quality Assurance Organization training on June 6, 2019.

c) Preparation of AQI Guidance Document
   During the Camp Fire event, the District identified a knowledge gap in the community with regards to air monitoring. Given the new technology presented by

Purple Air, there was some question among air quality professionals about the reliability and accuracy of these new air pollution sensors. There was also a general misunderstanding among the public about the difference between the Purple Air sensors, and the official FEM monitors represented in the AirNow network. The District prepared the AQI Guidance Document and published it to the web in order to explain how to interpret the data put out by the various air pollution monitors and sensors. In addition, the District published other air quality resources related to wildfire smoke during that time. The District referenced the Guidance Document when interfacing with school districts, in an effort to assist with crafting appropriate guidelines for schools' response to wildfire smoke conditions. The document is included in Attachment 2.

d) Presentation at Meeting with SCOE and School Districts

During the Camp Fire event, the District observed some AQI guidelines released by the Sonoma County Office of Education ("SCOE") that relied on air quality data from Purple Air sensors. SCOE and its associates had set an arbitrary threshold of 275 AQI for the recommended closure of schools, with the thought process being that Purple Air was more desirable because there was a greater amount of data points than those provided by the FEM network AirNow, and because Purple Air sensors tend to read higher than FEMs, a higher threshold (than neighboring Napa County's guidelines threshold of 150 AQI) would be appropriate.

Seeing some gaps in logic in this approach, the District wanted to make sure that SCOE and school districts/school administrators had a thorough technical understanding of AQI and of the different types of sensors available, so the District offered its expertise to SCOE. SCOE asked the District to do a presentation to SCOE and school district representatives in order to explain air monitoring instrumentation and give school administrators better understanding of the air quality equipment they were relying upon to make their decisions.

At the SCOE meeting on December 5, 2018, the District presented information about Purple Air sensors versus FEM air monitors (presentation included in Attachment 3). This presentation was influential in the development of more informed SCOE and school district policies.

e) Assistance with Preparation of SCOE and Statewide AQI Guidance for Schools

The District's presentation prompted SCOE and school district superintendents to revise their wildfire event school guidelines. The District was an active participant in the guideline revisions, making ample comments throughout the process. The finalized local SCOE/school district guidelines were then used to influence the creation of statewide guidelines, which were requested and spearheaded by California Senator Mike McGuire. The finalized statewide guidelines are included as Attachment 4.

Through the District's offering of technical expertise and collaboration in SCOE's guideline writing process, the District was able to influence local and statewide policymaking with regards to wildfire smoke response for schools. If the District had not reached out, SCOE and the school districts might not have gleaned as much understanding about interpreting air quality results from air pollution sensors

and FEM monitors, and might not have revised their guidelines in such a comprehensive way. Having now established a relationship with SCOE and the school districts, the District has an easy avenue for future collaborations in service of its CAP/community air monitoring campaign addressing the significant exposure burden of wildfire events for schoolchildren.

4. Grant Funds

a. Received so far: **$8,998**

b. Remaining: **$5,000.00 FY 17/18; $22,659 FY 18/19**

5. Itemized Invoice Information

The following is a summary of staff time used in the foregoing tasks. As several different District staff members participated in this effort, a weighted average of staff labor rates is used for the purposes of this calculation.

Community Air Protection Tasks Performed by NSCAPCD Staff for FY 17/18 (from March 1, 2018 to January 31, 2019)	**Staff Hours Worked**	**Dollar Amount**
2018 District Grant Services Weighted Labor Rate	**$93/hour**	
Deployment of Purple Air Units	80	
Analysis of Purple Air Results during Event	72	
Preparation of AQI Guidance Document	64	
Presentation at Meeting with SCOE and School Districts	72	
Subtotal for FY 17/18	288	$26,784
Community Air Protection Tasks Performed by NSCAPCD Staff for FY 18/19 (from February 1, 2019 to January 31, 2020)		
Assistance with Preparation of SCOE and Statewide AQI Guidance for Schools	48	
Final Report	32	
Subtotal for FY 18/19	80	$7,440
Total	**368**	**$34,224**
Grant Disbursement Received July 2018		$8,998

Grant Invoice Amount: FY 17/18 (from available funds for 17/18)		$5,000
Grant Invoice Amount: FY 18/19 (from subtotal above)		$7,440
Total Grant Invoice Amount		**$12,440**
Remaining Grant funds from FY 18/19, to be reimbursed in the future		$15,219

Attachment 1: NSCAPCD Purple Air Presentation

Attachment 2: Guidance Document for Air Monitoring Data

Attachment 3: NSCAPCD Presentation to Sonoma County Office of Education

Attachment 4: Statewide School Guidance Document

Attachment 1: NSCAPCD Purple Air Presentation

NSCAPCD Camp Wildfire Response November, 2018

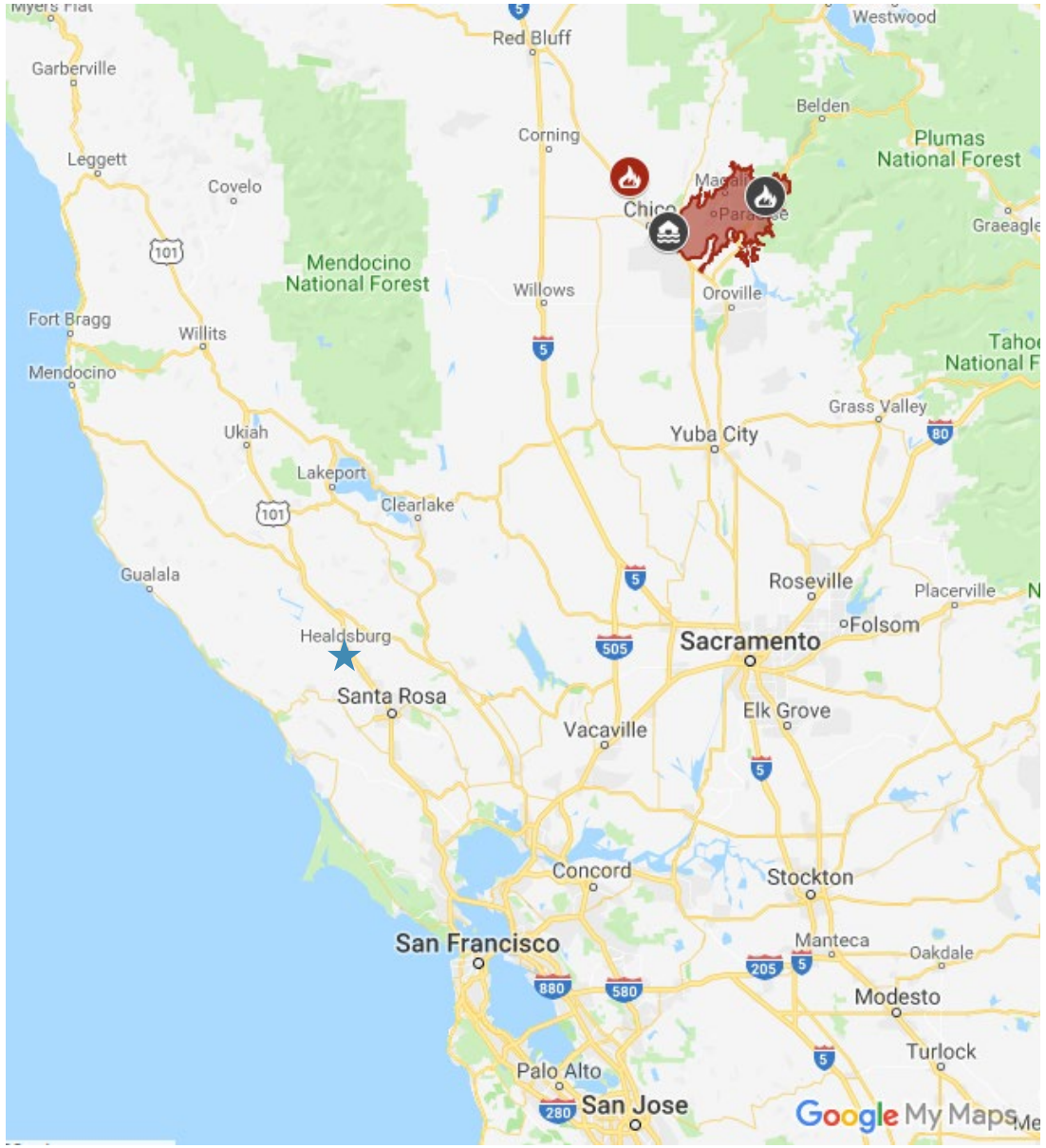
Lilian R. Turcios
Air Quality Monitoring

“Every person who prepares is one less person who panics in a crisis”

-Mike Adamson, British Red Cross

Recent Wild Fire Impacts in N. Sonoma County

- 2017 Tubbs, Pocket, and Nuns Wild Fires
  - October 8th- October 31st,2017
  - Local impacts included significant structural damage and smoke
  - District data impacted from October 9th-October 16th (~8 days)
  - Max hourly concentration of 356 ppm (PM10 BAM 1020- Cloverdale)
- 2018 Camp Wild Fire
  - November 8th- November 25th, 2018
  - Local impacts were limited to smoke
  - District data impacted from November 8th-November 20th (~13 days)
  - Max hourly concertation of 403 ppm (PM10 BAM 1020- Guerneville)


Red Bluff
Garberville
Westwood
Belden
Corning
Plumas
National Forest
Leggett
Covelo
Chico
Graeagle
101
Mendocino
National Forest
Willows
Oroville
Fort Bragg
Willits
Mendocino
Grass Valley
Ukiah
Yuba City
Lakeport
Clearlake
101
Gualala
Roseville
Placerville
Folsom
Healdsburg
Sacramento
505
Santa Rosa
Elk Grove
Vacaville
Concord
Stockton
San Francisco
Manteca
Oakdale
880
580
205
Modesto
Turlock
Palo Alto
San Jose
280
Google My Maps

District Concerns and Challenges

- Equipment and Coverage
  - Do we have the right equipment to capture these events?
  - Are there areas in the district that need more coverage that aren't already covered by existing network?
- Data Capture
  - Which data sources are the most accurate, and easily explained to the public?
  - Why is there so much data, and where is it all coming from?
- General Public Queries
  - How do we properly message the data that is being collected?
  - Are there policies or guidelines available to schools and places of employment that protect public health?

Camp Fire: Smoke in Sonoma County

November 8th, 11:52 AM

November 8th, 12:03 PM

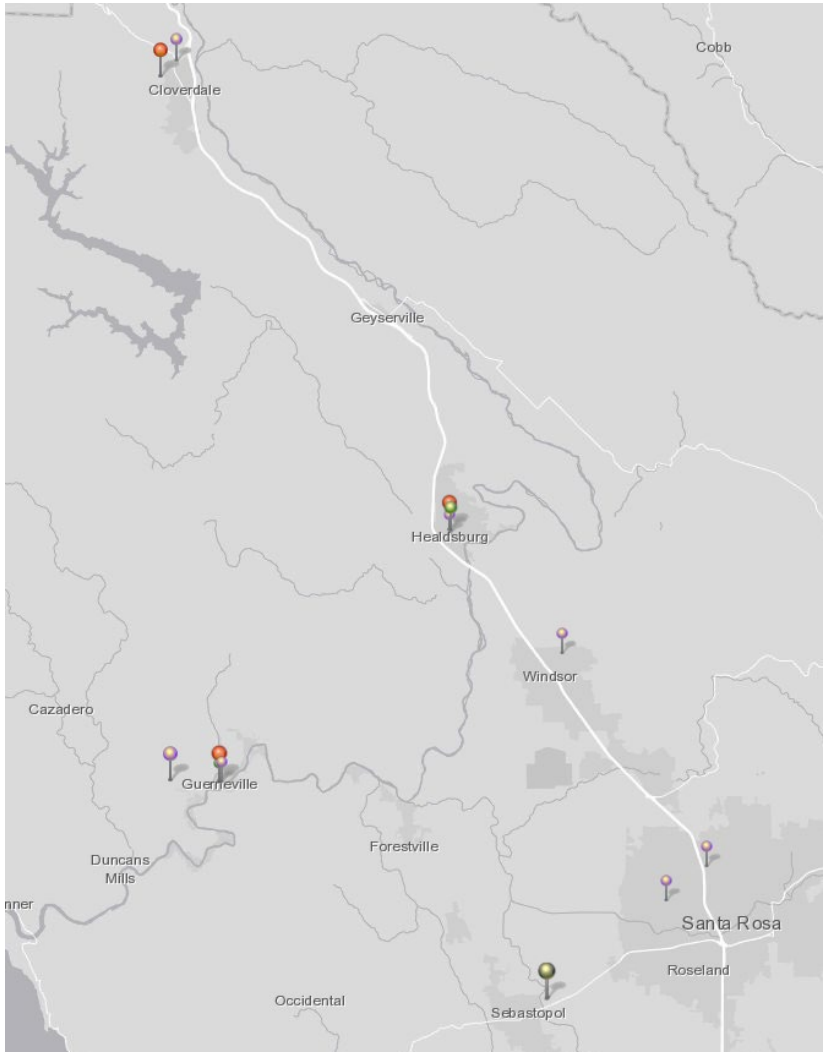
Healdsburg, California

Camp Wildfire: Smoke in Sonoma County

- Tools available for monitoring smoke impact:
  - Existing Network
    - PM_{10} –NSCAPCD
    - $PM_{2.5}$ –BAAQMD
  - Other Technology
    - PurpleAir Sensors
    - E-BAM's ($PM_{2.5}$)- CARB

Continuous Monitors & PurpleAir

- Current Network
  - BAM-1020 for PM_{10}, BAM-1020 for $PM_{2.5}$, and Ozone Analyzers
- Deployed at time of Smoke Event
  - 8 PurpleAir Sensors- readily available, soon after event started
    - 7 Outdoor across N. Sonoma County
    - 1 for indoor use in District Office
  - 3 E-BAM's for PM 2.5 provided by CARB
    - E-BAM's were placed near existing PM 10 monitors on November 19th



Existing Network

Advantages

- Sites are well established (over 20 years)
- Site locations provide for excellent coverage of jurisdiction
- AirVision allows staff to access hourly data remotely

Limitations

- District only monitors for PM_{10} and relied on BAAQMD's $PM_{2.5}$ monitor in Sebastopol during fire event
- Data that District collects is accessible to public in limited form
- AirNow does not have access to District generated data

PurpleAir

Advantages

- Easy to distribute and deploy
- Low Cost
- User-Friendly online web interface
- Near real time readings

Limitation

- Dust (soot) can settle inside device, causing Optical Particle Sensor (OPS) to drift over time [2]
- Aerosols (biomass burning, sea salt, fog) can cause higher counts due to limitations of OPS tech [3]
- Smoke composition and particle size may vary, causing lower/higher counts[3]
- Updates ~20 seconds, creating large data set

CARB Deployed E-BAM

Advantages

- No cost for District
- CARB provides easy set up options
- Access to data remotely

Limitations

- E-BAM's were not available for deployment until several days after event began
- Deployment logistics
- Pre-incident baseline not captured

Camp Wildfire: Smoke in Sonoma County

Typical Fall Day

November 8th, 12:35 PM

Cloverdale, California

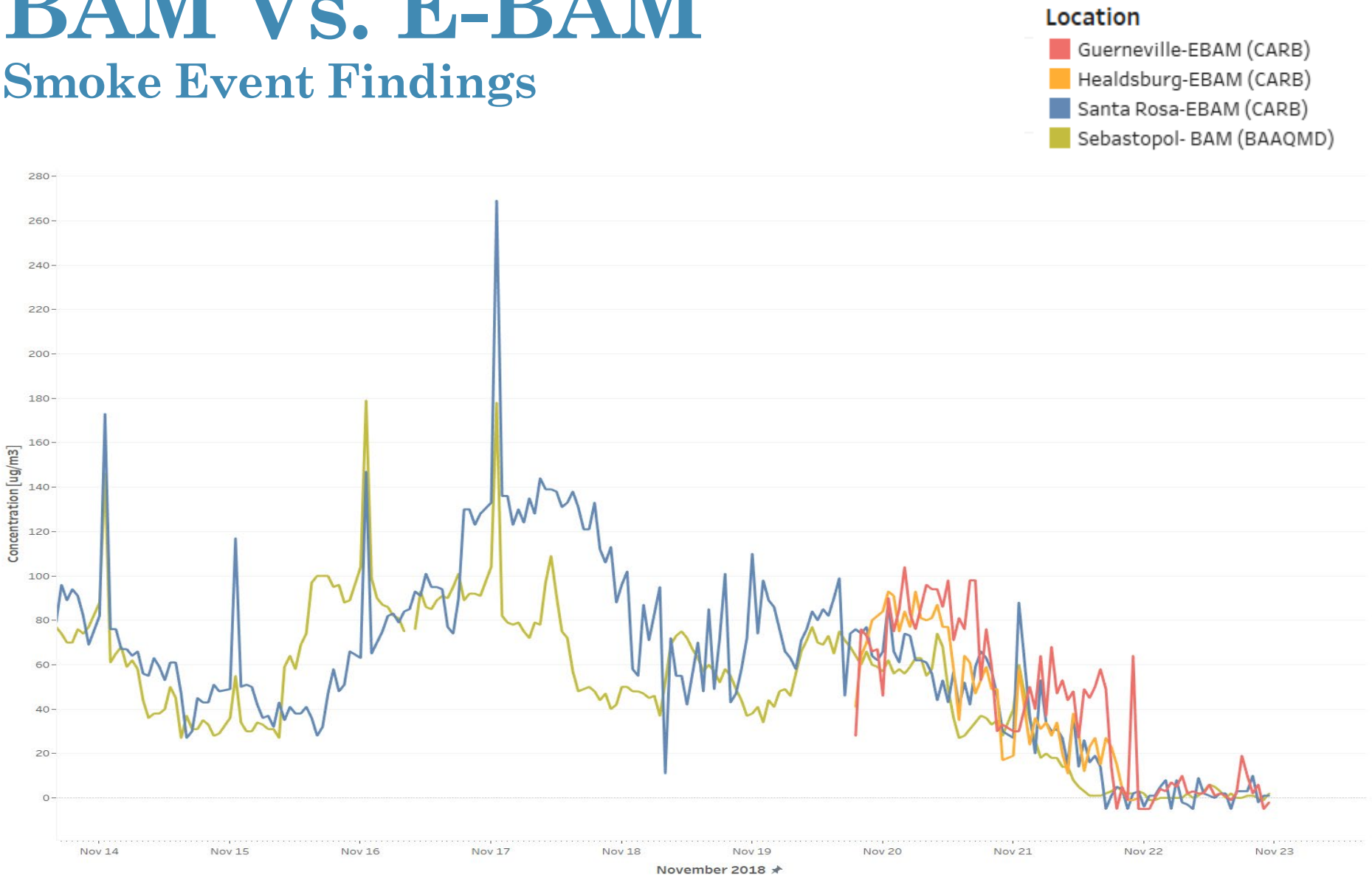
Data Collection & Analysis

- Data gathered from 4 different sources
  - BAAQMD
  - AirFire
  - PurpleAir
  - AirVison
- Finding Consistency for Comparison
  - By Measurement (PM_{10} vs. $PM_{2.5}$)
  - Time
  - Location
  - Source

- Important questions:
  - How well are PurpleAir's performing during wildfire event?
  - Can we compare indoor vs. outdoor PurpleAir values?
  - Is PM_{10} still a relevant source of data during wildfire event?
  - Was there enough data from the E-BAM's deployed for comparisons to be made?
  - How can the District communicate findings to the public and decision makers?

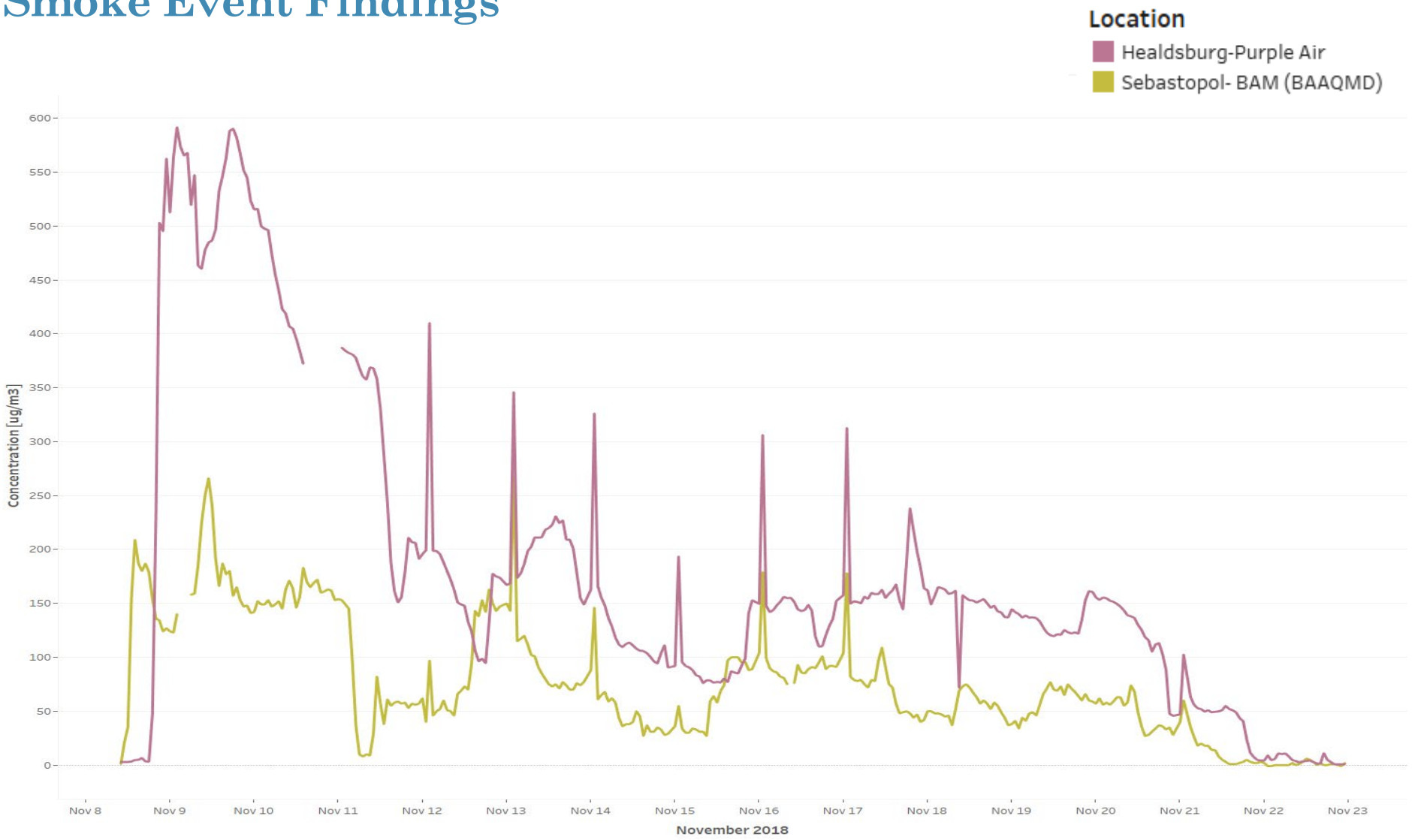
BAM Vs. E-BAM

Smoke Event Findings



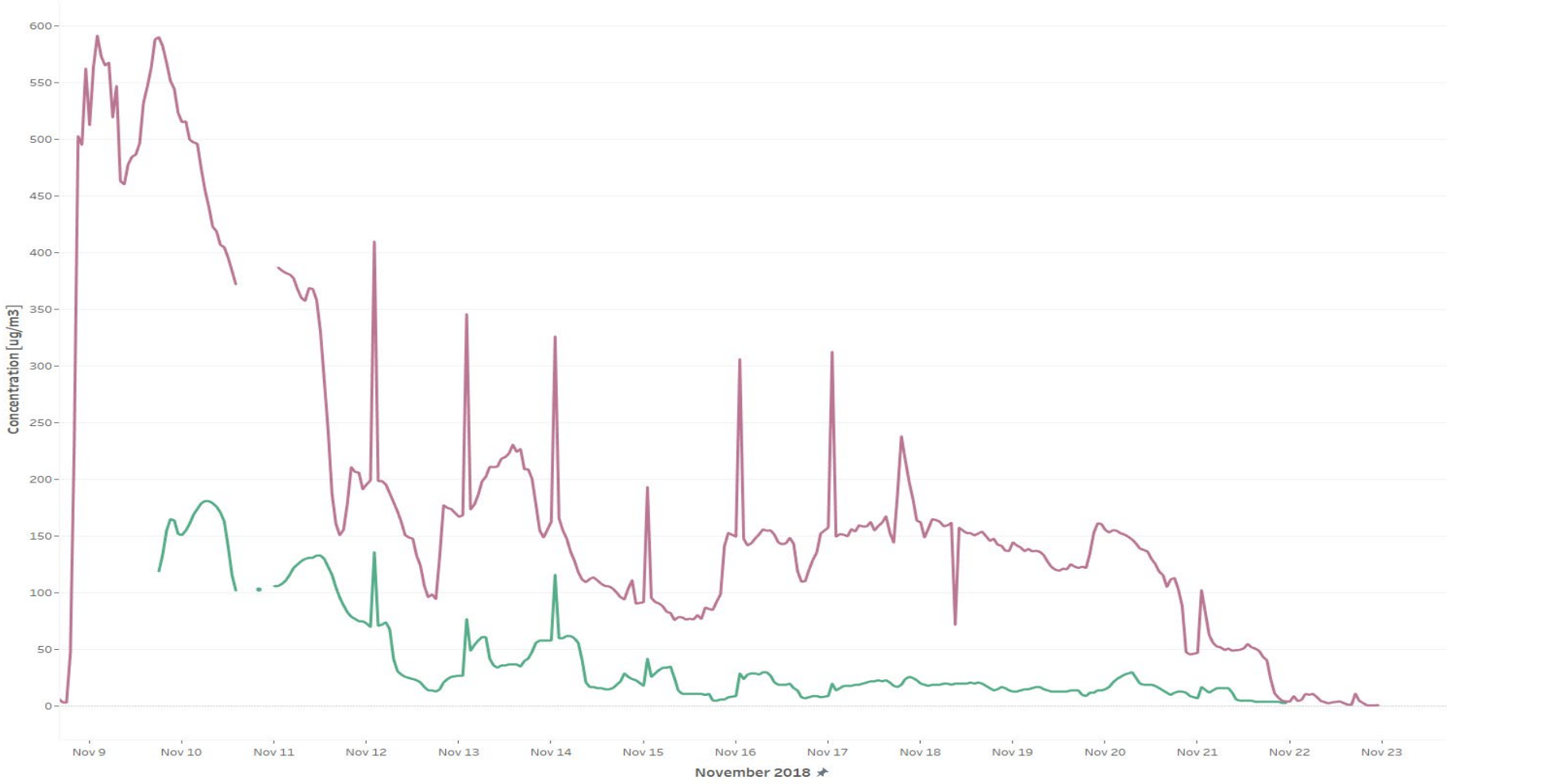
PurpleAir vs. Sebastopol BAM-1020

Smoke Event Findings



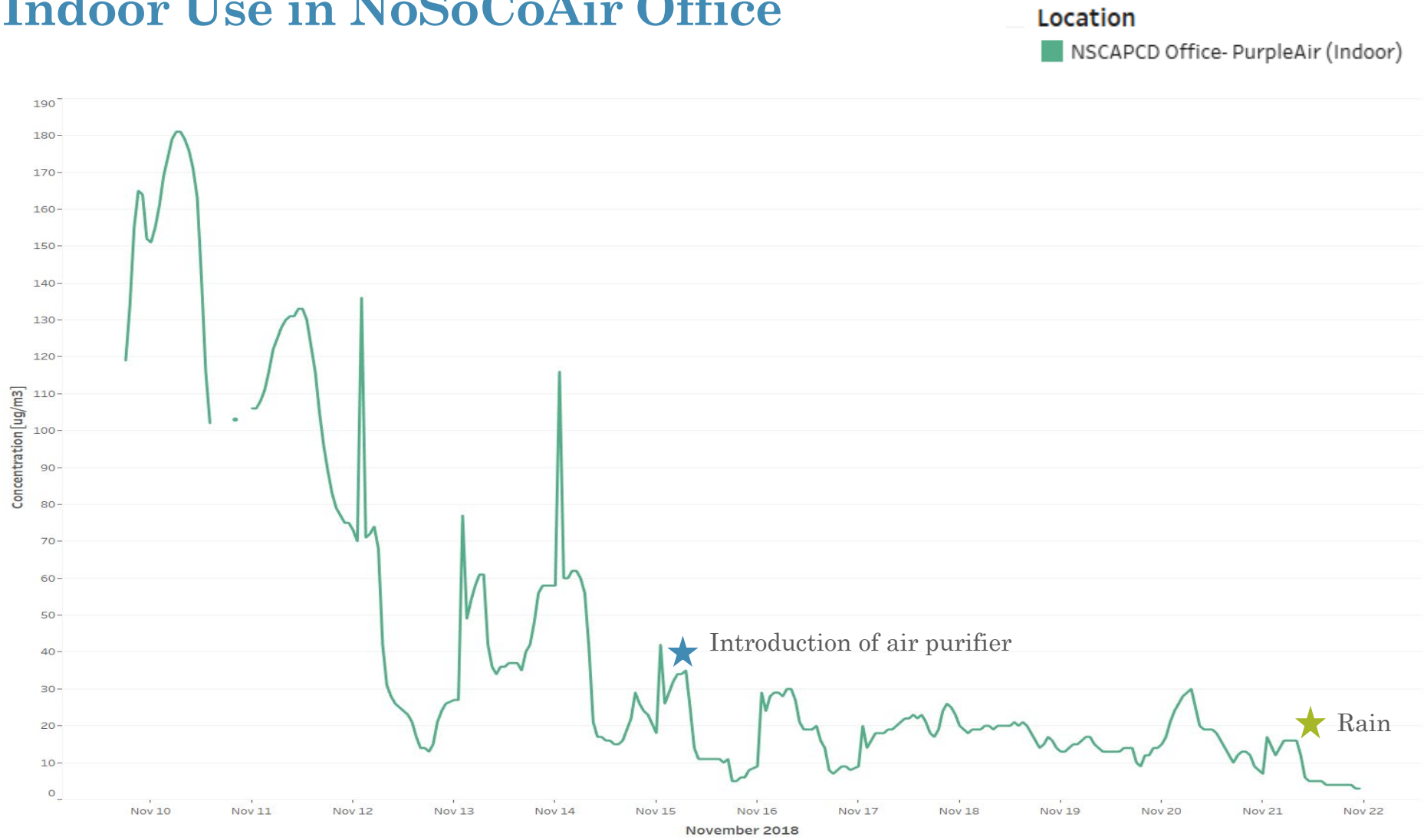
PurpleAir:

Outdoor vs. Indoor Use in NoSoCoAir Office



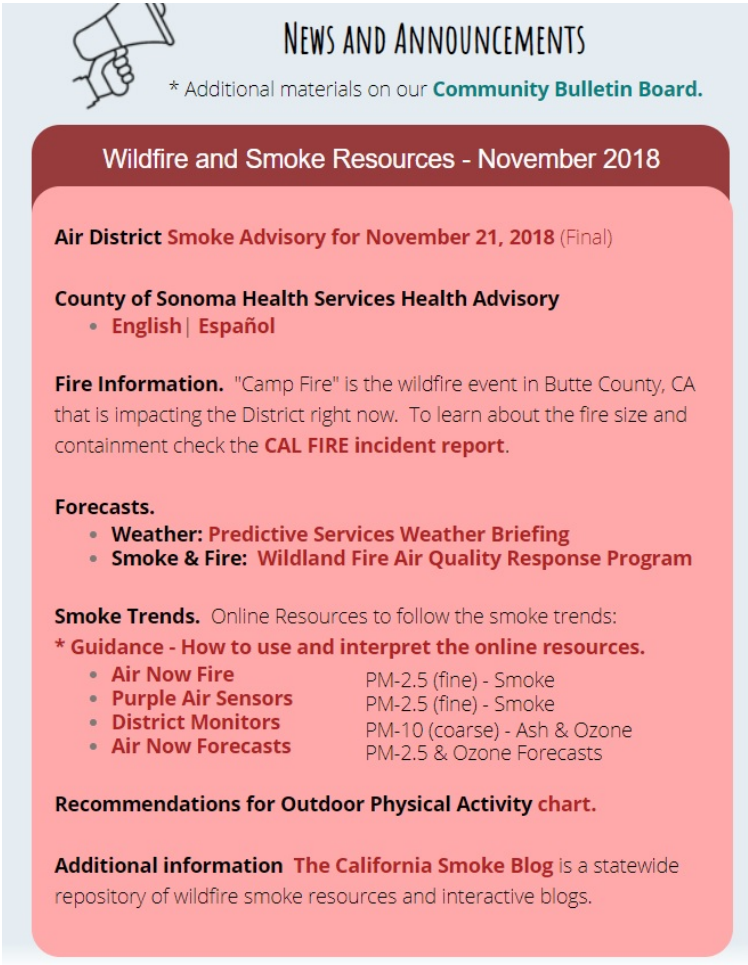
PurpleAir:

Indoor Use in NoSoCoAir Office



Addressing Public Concern

- Phone/Email responses by staff
- Social Media postings
- Smoke Advisories
- Guidance Documents (handouts)
- Wildfire & Smoke Resources Board on Website
- Sonoma County Office of Education Meeting



News and Announcements

* Additional materials on our **Community Bulletin Board.**

Wildfire and Smoke Resources - November 2018

Air District Smoke Advisory for November 21, 2018 (Final)

County of Sonoma Health Services Health Advisory
- **English** | **Español**

Fire Information. "Camp Fire" is the wildfire event in Butte County, CA that is impacting the District right now. To learn about the fire size and containment check the **CAL FIRE incident report**.

Forecasts.
- **Weather: Predictive Services Weather Briefing**
- **Smoke & Fire: Wildland Fire Air Quality Response Program**

Smoke Trends. Online Resources to follow the smoke trends:

*** Guidance - How to use and interpret the online resources.**

Air Now Fire	PM-2.5 (fine) - Smoke
Purple Air Sensors	PM-2.5 (fine) - Smoke
District Monitors	PM-10 (coarse) - Ash & Ozone
Air Now Forecasts	PM-2.5 & Ozone Forecasts

Recommendations for Outdoor Physical Activity chart.

Additional information The California Smoke Blog is a statewide repository of wildfire smoke resources and interactive blogs.

Sonoma County Office of Education (SCOE) Meeting: December 5, 2018

Sonoma County Schools Air Quality Guidelines

Prepared in collaboration with the county's 40 school districts

Sonoma County Office of Education

HOW TO USE THIS CHART:

1. On days with questionable air quality, superintendents shall check purpleair.com at **5:00am**.
2. If the Air Quality Index (AQI) is listed at 275 or above, districts may cancel classes. The superintendent will notify the county superintendent, their district staff and families.
3. District/Site staff must be informed of any and all restrictions that are in place based on the AQI as noted on the table below.
4. Personnel: At an AQI of 275 or above, school is closed. Essential personnel (maintenance, administrative) may be called in to work.

AQI Index		Recommended Actions			
	School in Session?	Recess / Lunch	Physical Education	Athletic Practice & Training	Scheduled Sporting Events
GOOD (0-50)	Yes	No Restrictions	No Restrictions	No Restrictions	No Restrictions
MODERATE (51-100) Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion	Yes	Ensure unusually sensitive individuals are medically managing their condition	Ensure unusually sensitive individuals are medically managing their condition.	Ensure unusually sensitive individuals are medically managing their condition.	Ensure unusually sensitive individuals are medically managing their condition.
UNHEALTHY FOR SENSITIVE GROUPS (101-150)[1] Everyone should limit prolonged or heavy outdoor activities, especially children, older adults, and people with heart or lung disease. All doors and windows must remain closed throughout the day.	Yes	On campus/indoor lunch strongly recommended for all high school students: Mandatory for Elem/Middle.	Reduce vigorous exercise to 30 min per hour. May move indoors or modify activity as necessary.	Reduce vigorous exercise to 30 min per hour of practice time with increased rest breaks and substitutions. May move indoors or modify activity as necessary.	Increase rest breaks and substitutions per CIF guidelines for extreme heat. May move indoors or modify activity as necessary.
UNHEALTHY (151-200) The following groups should avoid all physical outdoor activity: People with heart or lung disease, children and older adults. Everyone else should avoid prolonged or heavy exertion	Yes	All activities should be moved indoors as much as reasonably possible.	All activities should be moved indoors as much as reasonably possible.	All activities should be moved indoors as much as reasonably possible.	Event should be rescheduled or relocated.
VERY UNHEALTHY (201-300) Everyone should avoid any outdoor exertion; people with respiratory or heart disease, the elderly and children should remain indoors.	Yes (< 275) No (> 275) Classes cancelled at district's discretion	No outdoor activity. All activities should be moved indoors.	No outdoor activity. All activities should be moved indoors.	No outdoor activity. All activities should be moved indoors.	Event must be rescheduled or relocated.
HAZARDOUS (300-500) Everyone should avoid any outdoor exertion; people with respiratory or heart disease, the elderly and children should remain indoors.	No	No outdoor activity. Avoid any prolonged, moderate, or vigorous indoor activity.	No outdoor activity. Avoid any prolonged, moderate, or vigorous indoor activity.	No outdoor activity. Avoid any prolonged, moderate, or vigorous indoor activity.	No outdoor activity. Avoid any prolonged, moderate, or vigorous indoor activity.

1) **Sensitive Groups** include all children under age 18 and adults with asthma or other heart/lung conditions.

SCOE Meeting Summary

- District staff met with
  - 15 School Districts
  - SCOE
  - County Public Health Director
  - BAAQMD
- SCOE considering change from PurpleAir to AirNow website
- District used as technical source
- No known appropriate AQI threshold to close schools established
- Statewide guidance is needed to help schools make decisions
- Student shelter-in-place at school preferable to school closure
- District offered assistance interpreting air quality data in the future

Things to Consider

- Connecting with other agencies
  - Local
  - Other Air Districts
- Network Coverage and Assessment
  - Equipment
  - Staff
- Data
  - Validity
  - Impacts
- Staff Safety
  - PPE
- Public Involvement
  - New Technology for Citizen Science

Comments or Questions?

Lilian.Turcios@Sonoma-County.org
(707)565-7121

Attachment 2: Guidance Document for Air Monitoring Data

N.S.C.A.P.C.D.
NORTHERN SONOMA COUNTY
AIR POLLUTION CONTROL DISTRICT
150 Matheson Street, Healdsburg, CA 95448 • PH: (707) 433-5911 • FX: (707) 433-4823

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

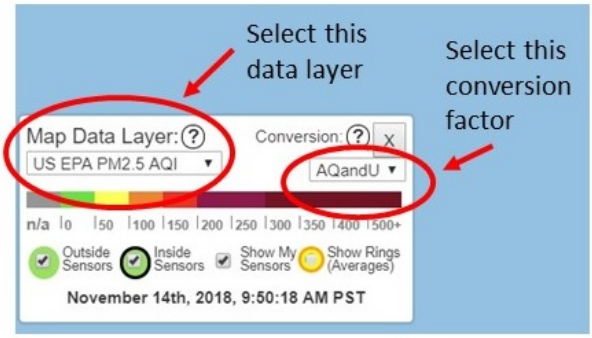
It is important to use online resources in a complimentary way, recognizing that they are meant to do different things and therefore will have different values. To assess air quality during wildfire or emergency conditions, the District recommends reviewing websites in the following order:

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.

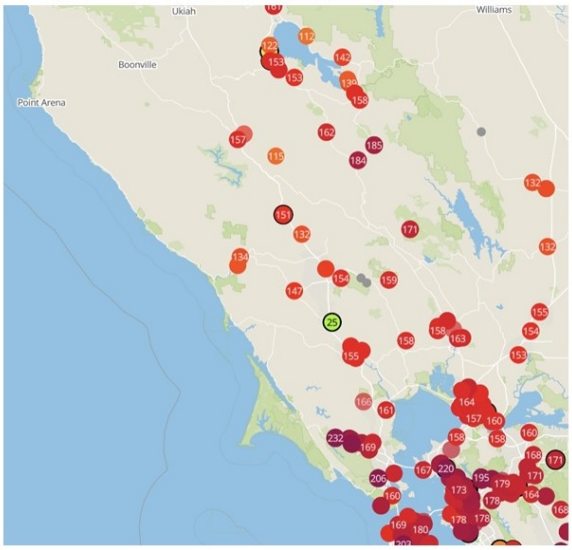
The color coding indicated on the maps is the 'AQI' or Air Quality Index. This index, developed by the Environmental Protection Agency, defines different thresholds of air pollution concentrations based on their estimated impact upon human health, and gives general descriptions of health risk for each 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.



PurpleAir has the most sites and greatest distribution.



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.

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.

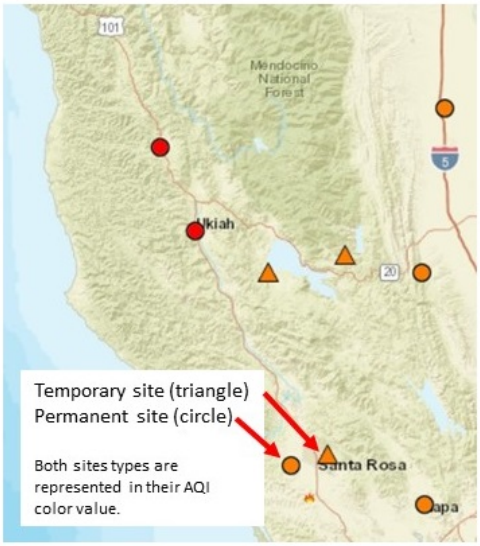
The colorful map visible on the AirNow site main page is simply an estimate and does not reflect actual measured AQI in all locations. The advantage to this is that it can help estimate air quality in areas that do not have monitors; but the disadvantage is that the reliability of the estimated AQI decreases 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: Current and Forecast AQI

"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.

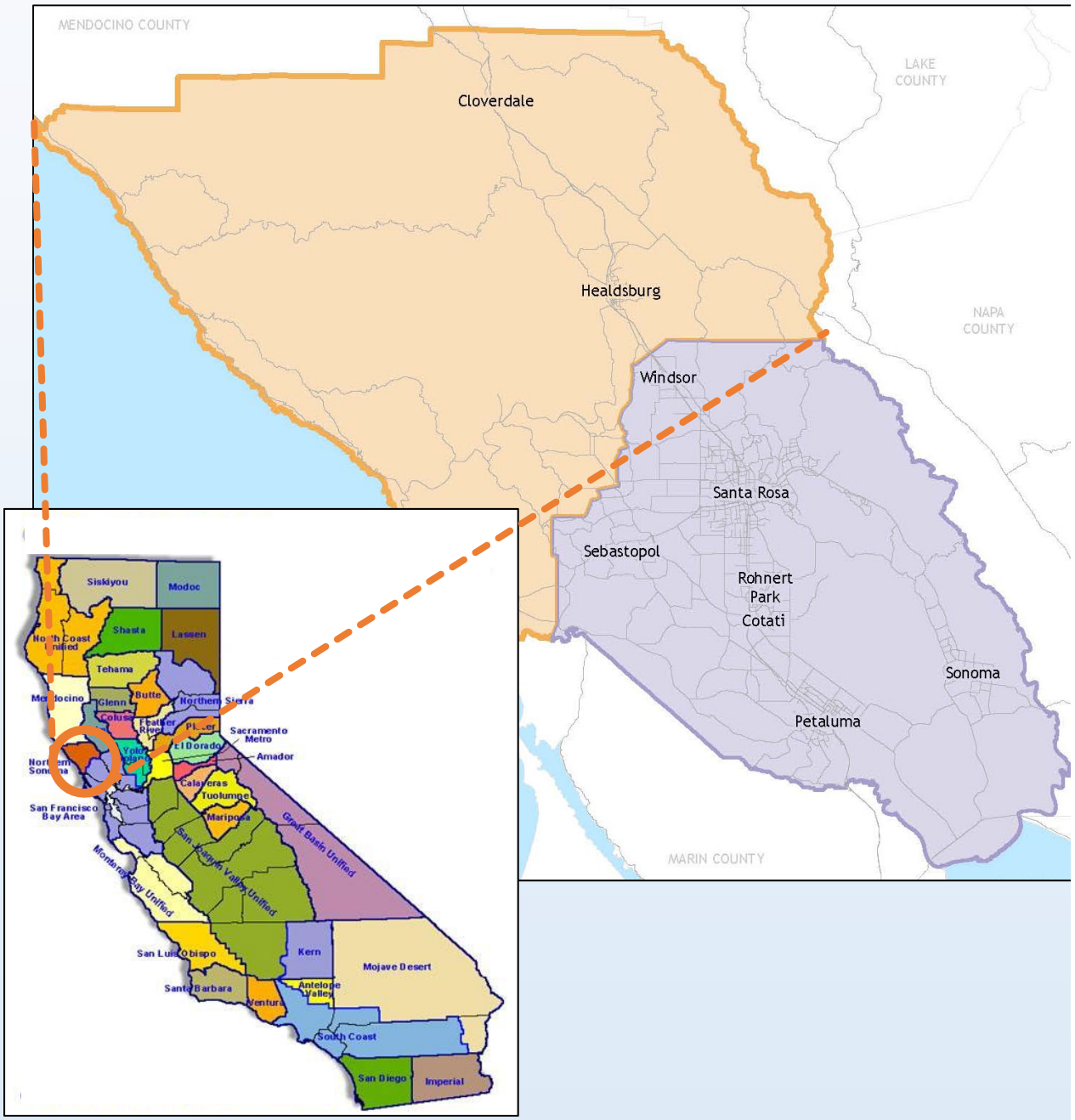


Attachment 3: NSCAPCD Presentation to Sonoma County Office of Education


Northern Sonoma County
Air Pollution Control District
"Clean Air, Good Living"
NSCAPCD
Sonoma County Office of Education & NSCAPCD
Air Quality Standards Task Force Meeting - December 5, 2018

Air District

- Northern Sonoma County.
- Enabling authority from State legislature in Health and Safety Code.
- Implements CA and Federal Clean Air Acts.
- Primary responsibility to permit stationary sources.
- Regulatory & enforcement authority.



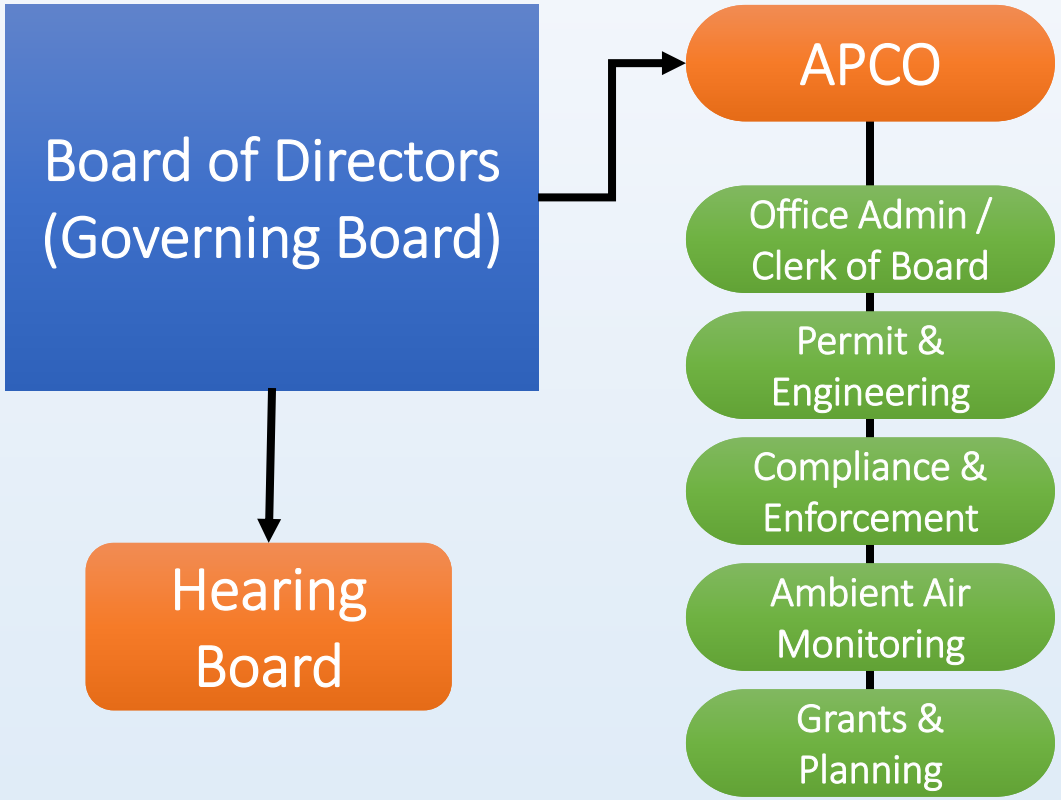
What is an Air District?

- Stand alone legal entity separate from the county: "a.k.a state special district."
- Self-funded (no county general fund)

What Does an Air District Do?

- Protects air quality and public health.
- Ensures air quality meets the standards for clean air required by federal and state law.
- Ensures operations and activities that cause air pollution comply with regulations and requirements.
- Provide grants and incentives for clean air projects.
- Respond to public complaints, concerns, and questions about air quality and its health impacts.

NSCAPCD Structure



Governing Board

- Board of Directors provides policy and governance.
- (2) Sonoma County BOS & (3) City Council Members.

Hearing Board

- Provides due process & variances for violations.
- (5) community members appointed by Directors.

APCO / Executive Officer

- Observes & enforces regulations & permits.
- (1) appointed to District by Directors.

District Team

- Admin, science & engineer.
- (5) FTE

NSCAPCD Program Activity

4,124 Active Permits:

3,186	**Open burn**
2,269	Residential
917	Agricultural
920	**Stationary**
12	Major Source
480	Geothermal
163	Ag. Engines
22	Gas Station
243	**Other** Minor Source

4 Monitor Sites:

Healdsburg Downtown:	PM-10
Cloverdale:	PM-10
Guerneville:	PM-10
Healdsburg Airport:	Ozone

Incentive Programs Grand Total Since 1995:

$7,749,167

Incentive Programs FY 2017-18

$961,713

- **35** Woodstoves replaced
- **12** Clean diesel tractors
- **124** EV rebates / home chargers
- **7** Public EV charging stations
- **1** Alternative Transportation Project
- RCPA for GHG / Climate Mitigation

Air Quality Standards

Established to protect the health of the most sensitive groups in our communities. Defines the maximum amount of a pollutant averaged over a specified period of time that can be present in outdoor air without any harmful effects on people or the environment.

Federal - NAAQS

The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants").

- Carbon Monoxide (CO)
- Particulate Matter < 10 microns (PM-10)
- Particulate Matter < 2.5 microns (PM-2.5)
- Nitrogen Dioxide (NO2)
- Sulfur Dioxide (SO2)
- Lead

State - CAAQS

The CA Legislature directed the State Dept of Public Health to develop California Ambient Air Quality Standards (CAAQS). CAAQS are often more stringent than NAAQS.

- Criteria (NAAQS) pollutants, plus:
- Sulfate
- Vinyl Chloride
- Hydrogen Sulfide (H2S)
- Visibility Reducing Particles

Where Does Our Pollution Come From?

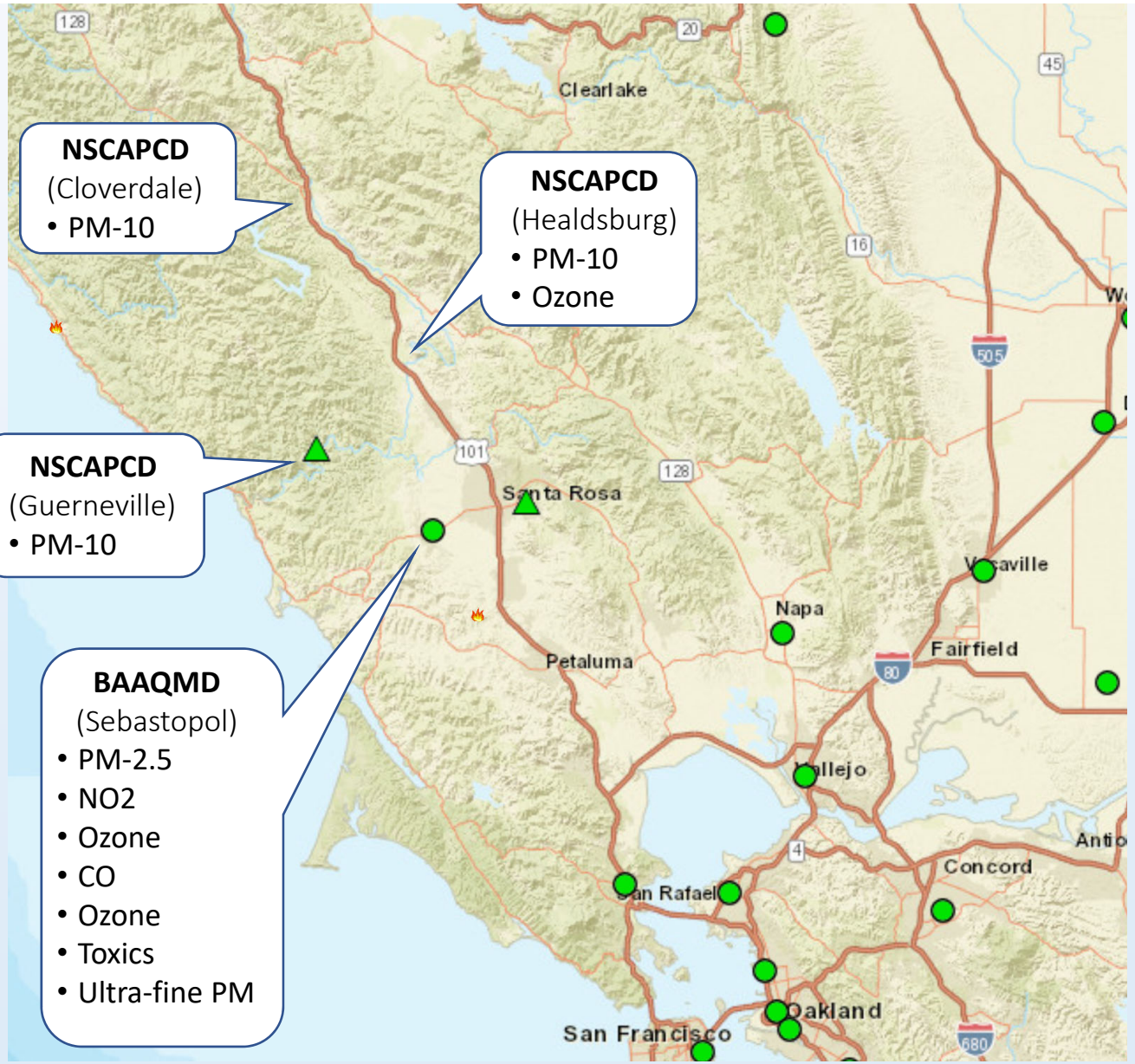
- Large industrial operations
- Smaller commercial businesses
- Agriculture
- Fireplaces
- Vehicles
- Wildfire Smoke

Air District Monitoring

- Ambient air monitoring: systematic, long-term assessment of pollutant levels by measuring the quantity / types of certain pollutants in the surrounding, outdoor air.
- Different methods to measure any given pollutant.
- Locations for monitoring stations depend on the purpose of monitoring.
- EPA develops requirements and guidance for design and operation of these networks.

Monitoring Sites in Sonoma County

- Nominal monitoring requirements for pollutants defined in federal rule.
- Reqts to monitor triggered by population thresholds and/or measured air quality.
- Sites listed in the State's Annual Network Plan.
- Typically 1 set of criteria pollutant monitors per county (SoCo--Sebastopol).

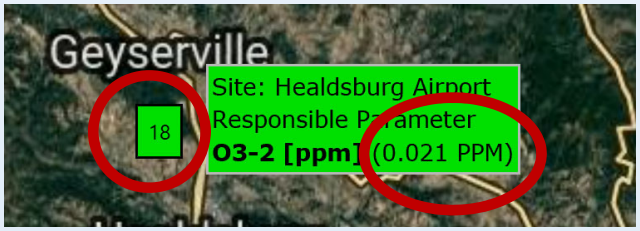


Measurements vs Air Quality Index (AQI)

<u>Ambient Air Quality Standards</u>
Air pollutant measurements as concentrations over a given time period (µg/m^3 or ppm).

<u>Air Quality Index (AQI)</u>
Not actual ambient air measurements; an index that ***relates to air pollution levels*** by transforming ambient concentrations to a scale from 0 to 500.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.



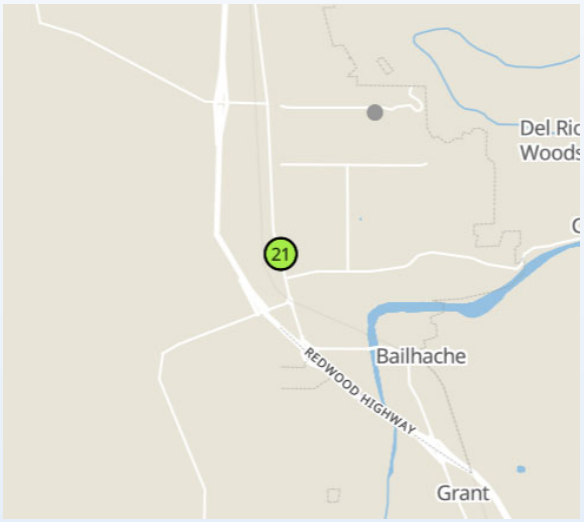
Why is AQI used?

- Simplifies reporting air quality to the general public.
- Divided into general categories associated with health messages.
- Conveys health implications of air quality.

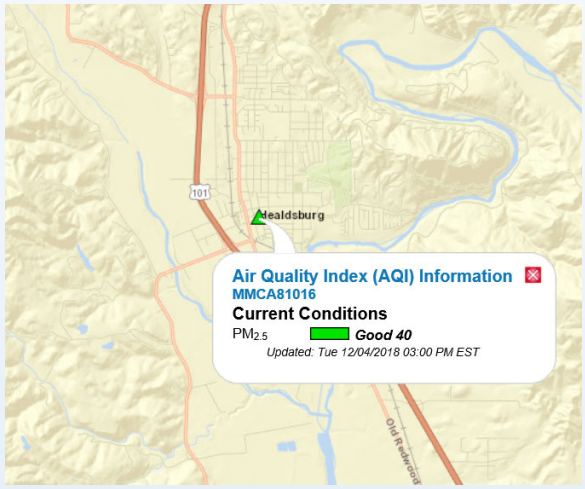
Example (ozone):
Measured = 0.021 ppm
AQI = 18

I Checked the Web:

(same time, for the same location)

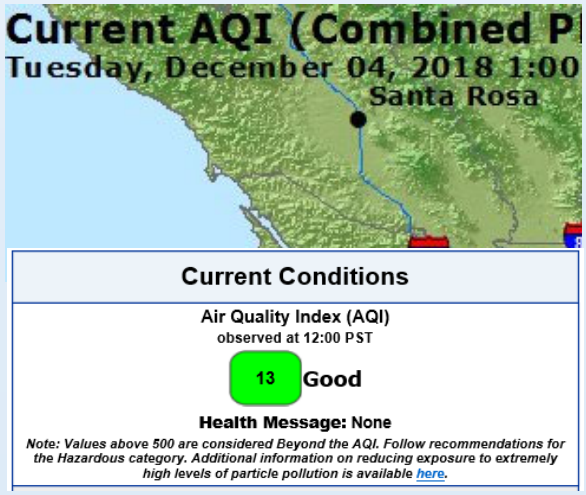


PurpleAir
AQI = 21
(PM-2.5)



AirNow – Fire
AQI = 40
(PM2.5)

District
AQI = 13
(PM-10)

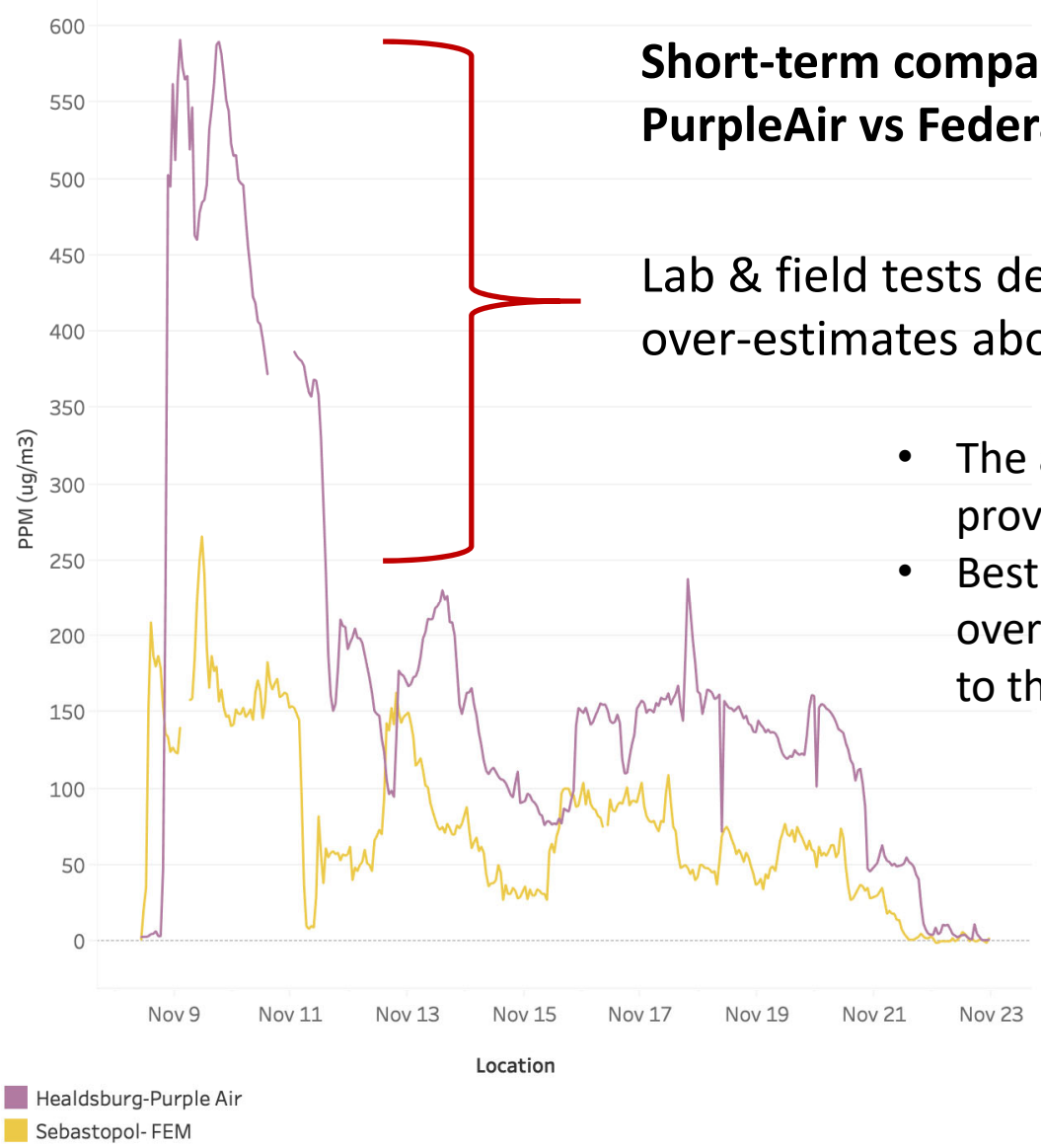


AirNow – Current AQI
AQI = 13
(PM2.5)

Monitor vs. Sensor (PM-2.5 example)

Federal Reference Method	Purple Air
Operated by govt agency with trained operators.	Personal sensor; plug & play; no expertise required.
Siting and scale requirements in rule.	No siting and scale requirements / standards.
Data capture & QA/QC requirements in rule (data certified by District, ARB, & EPA).	No data requirements / standards.
Calibration & maintenance requirements in rule.	No calibration / maintenance standards.
Default display is concentration measurements ($\mu g/m^3$, ppm).	Default display is AQI.
Calculates form of the standard utilizing 3 years of certified data.	Estimating AQI for an 8 or 12-hour period; not compliance with state & federal air quality standards.
Data loggers and storage systems.	Limited web application data storage.
Costs ~$75,000 to establish with ongoing ¼ FTE to operate/maintain.	Cost ~$230.
Used for regulatory decisions.	Not regulatory; personal use only.
Most accurate technology: Beta Attenuated Monitors and High Volume Air Samplers	Economic laser light refraction; prone to overestimation in a non-linear manner.

Variation Between Monitors & Sensors



Short-term comparison during wildfire: PurpleAir vs Federal Reference Monitor.

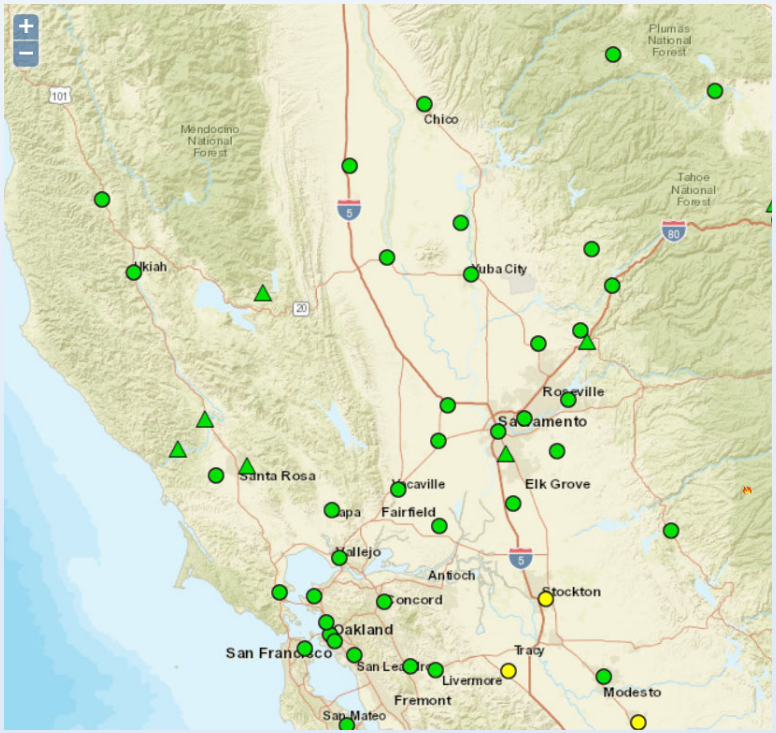
Lab & field tests demonstrate that PurpleAir over-estimates above 250µg/m^3 (AQI of 300)

- The amount of over-estimation has not proven to be linear or predictable.
- Best working theory is that overestimation and variability are due to the color of the PM.

Monitor vs Sensor Distribution (PM-2.5)

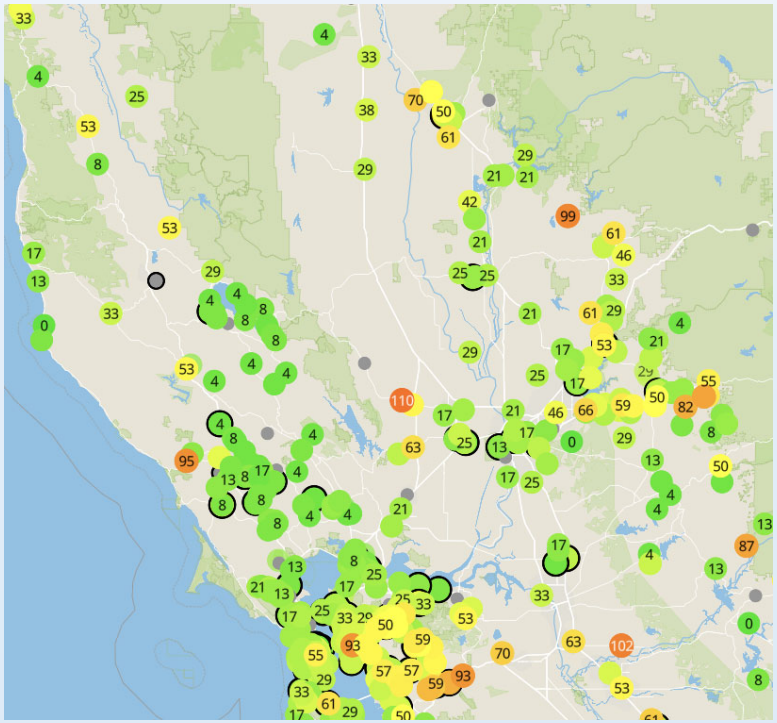
Federal Reference Monitor

- Most accurate, but limited distribution and number of monitors.
- 1-2 hour lag to refresh on web map.



PurpleAir Sensor

- Accuracy limitations, but rapidly growing network and number of sensors.
- Quick refresh. Useful for directional & time trends.



Wildfires: A "New Normal"

- Increasing in frequency and magnitude (more destructive than natural wildfires)
- Global warming / climate change.
- Tree mortality (over 29,000,000 dead trees in CA).
  - Beetle and pest infestation
- Forest management: the practice of prohibiting fires has created excessively dense tree counts and excessive fuel loading.
  - Alters watershed characteristics and biodiversity habitat
- More people moving into / living near wilderness-urban interface areas.
- Can be far away and still impact distant communities with dense smoke.
- Forest management solutions will be costly and slow to implement.

Air District Resiliency & Response

Resiliency: Ongoing / Planning

- Legislative Platform
- Lobby legislators
- Forest Management Task Force
- AB617 – Community Project
- Resiliency programs – supporting partner agencies & stakeholders

- **Air District implements air quality standards that are health-based, but it is not a health agency. Defers to Health Dept authority and expertise.**

Response at Onset of Wildfire

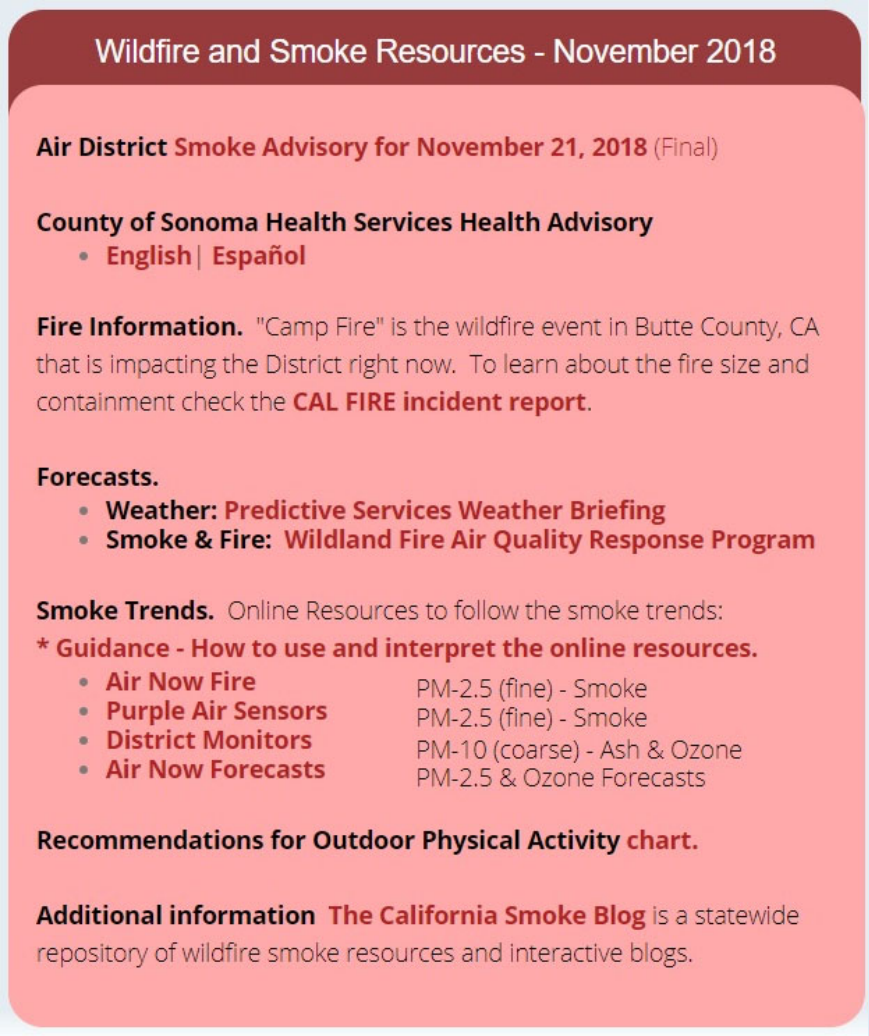
- Coordinate public advisory with Health Dept.
- Daily calls with OES, CARB, EPA, CAL FIRE, and neighboring districts.
- Answer increased amount of phone calls from concerned citizens.
- Bolster monitors to keep actionable data available, as monitor equipment tends to falter under heavy load (and intermittent power).
- Share equipment and staff resources with neighboring Districts at epicenter of event.
- Deploy portable sensors and monitors.
- Add wildfire event resources to website.
- Interface with School Districts?

Camp Fire Lessons Learned

- Wildfire smoke ubiquitous (fine particulate mixes well in the air and can be transported long distances).
  - Federal monitors in Sebastopol, Santa Rosa, Guerneville, and Healdsburg measured similar values.

<u>Air District Workplan</u>

- Specific website resources for wildfire event.
- Guidelines on how to use available online resources.
- Frequent Smoke Advisories.
- Access/availability of forecast services (ARA).
- Develop advisory & communication templates, including bilingual.
- SOPs for inter- & intra- Agency communication.



Wildfire and Smoke Resources - November 2018

Air District Smoke Advisory for November 21, 2018 (Final)

County of Sonoma Health Services Health Advisory
- English | Español

Fire Information. "Camp Fire" is the wildfire event in Butte County, CA that is impacting the District right now. To learn about the fire size and containment check the **CAL FIRE incident report**.

Forecasts.
- **Weather:** Predictive Services Weather Briefing
- **Smoke & Fire:** Wildland Fire Air Quality Response Program

Smoke Trends. Online Resources to follow the smoke trends:

*** Guidance - How to use and interpret the online resources.**

• Air Now Fire	PM-2.5 (fine) - Smoke
• Purple Air Sensors	PM-2.5 (fine) - Smoke
• District Monitors	PM-10 (coarse) - Ash & Ozone
• Air Now Forecasts	PM-2.5 & Ozone Forecasts

Recommendations for Outdoor Physical Activity chart.

Additional information The California Smoke Blog is a statewide repository of wildfire smoke resources and interactive blogs.

More Information

- Indoor Air Quality
  - PurpleAir (and other vendors) now offer affordable indoor sensors ($200+).
- Indoor Air Purification:
  - It works if HEPA & sized correctly.
  - Air District achieved 50 AQI reduction inside its old building with OTC HEPA filter.
- Masks:
  - Can give false sense of security w/o proper use & fit.
  - Can exacerbate breathing difficulty for sensitive breathers.

Air District(s) Support

Task Force Discussion

Some suggested topics…

- Work with Schools & Health Dept re: activity levels
- School closure – evaluation guidelines (inside & outside)
- Bilingual materials
- Indoor air quality / sensors
- AB617 project / resources.
- General air quality education
- Other?

Partnership Opportunities…
Collaboration…
Support…
Action Plan…


Comments or Questions?
"Clean Air, Good Living"

Attachment 4: Statewide School Guidance Document

Air Quality Guidance Template for Schools

About the Guidelines:

- These guidelines are based on the United States Environmental Protection Agency (U.S. EPA) and Centers for Disease Control's Air Quality and Outdoor Activity Guidance for Schools and Wildfire Smoke: A Guide for Public Health Officials. The guidelines are designed to assist in your decision-making process.

- **Modify the template and chart as needed after consultation with your local county office of education, local school districts, local air district, and local public health experts to determine which air quality monitoring methodology, such as Air Quality Index, total emissions concentration, or other air district-recommended method best applies in your school district.**

- **This template and chart are not intended to supersede existing guidelines and policies developed by local authorities, including the school districts or air districts.**

- These guidelines are intended to assist school districts in making decisions when air quality is poor. *School closure and event cancellation is ultimately a school district-by-school district decision based on local conditions.*

- The impact of smoke depends on the sensitivity of the person and the length of exposure, as outlined in the sample chart below. Children with respiratory or heart conditions are vulnerable to poor air quality and may require extra precautions. School districts should advise parents to consult with their family health care provider.

Using the Guidelines:

- School districts will need to monitor local air quality conditions using air quality tracking tools recommended by their local air district. One example of such a tool is U.S. EPA's air quality index (AQI) available at AirNow.gov. However, because other air quality tracking methodologies may be used in your jurisdiction, it is highly recommended to contact your local air district for advice on the most appropriate tools to use for your region.

- School districts should make decisions about school activities and closures based on air quality measurements and local conditions, such as the availability and quality of school building air filtration and direct observation of onsite indoor/outdoor air quality.

- School districts may wish to consult with their local air district regarding outdoor air and their local public health official regarding indoor air before making a final determination.

- School districts should report any school closures to their County Office of Education for media notification as well as announce closures to families using normal school closure procedures.

School Air Quality Activity Recommendations

PROTECT STUDENT HEALTH DURING POOR AIR QUALITY

Air quality is an important consideration for schools in terms of student activities. Local air districts are available to assist schools with understanding local air quality concerns and actions they can take to protect student health. To find out more, contact your local air district. Visit this page to learn which District serves your area: www.arb.ca.gov/app/dislookup/dislookup.php

The following school activity recommendations are based on consultation with health researchers and several important principles drawn from recent studies.
Modify these levels to correspond with the AQI, emissions concentration, or other air district recommended method for your region.

Activity	Air Quality Level				
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5 *School districts may consider school closures based on site-by-site concerns.*
Recess (15min)	No restrictions	Ensure that sensitive individuals are medically managing their condition.*	Sensitive individuals should exercise indoors or avoid vigorous outdoor activities.*	Exercise indoors or avoid vigorous outdoor activities. Sensitive individuals should remain indoors.*	No outdoor activity. All activities should be moved indoors.
P.E. (1hr)	No restrictions	Ensure that sensitive individuals are medically managing their condition.*	Sensitive individuals should exercise indoors or avoid vigorous outdoor activities.*	Exercise indoors or limit vigorous outdoor activities to a maximum of 15 minutes. Sensitive individuals should remain indoors.*	No outdoor activity. All activities should be moved indoors.
Athletic Practice & Training (2-4hrs)	No restrictions	Ensure that sensitive individuals are medically managing their condition.*	Reduce vigorous exercise to 30 minutes per hour of practice time with increased rest breaks and substitutions. Ensure that sensitive individuals are medically managing their condition.*	Exercise indoors or reduce vigorous exercise to 30 minutes of practice time with increased rest breaks and substitutions. Sensitive individuals should remain indoors.*	No outdoor activity. All activities should be moved indoors.
Scheduled Sporting Events	No restrictions	Ensure that sensitive individuals are medically managing their condition.*	Increase rest breaks and substitutions per CIF guidelines for extreme heat.** Ensure that sensitive individuals are medically managing their condition.*	Increase rest breaks and substitutions per CIF guidelines for extreme heat.** Ensure that sensitive individuals are medically managing their condition.*	Event must be rescheduled or relocated.

* Sensitive Individuals include all those with asthma or other heart/lung conditions ** California Interscholastic Federation

Additional Information & Resources

About AirNow.gov:

- A network of monitors maintained and operated by trained government agencies.
- It is recommended by many air districts, the California Air Resources Board, and U.S. EPA.
- AirNow monitors form a network to track regional air quality. Pollutants like smoke tend to be well-mixed in the atmosphere and may be adequately represented by these monitors, even if a monitor is not in the same neighborhood as a school.
- Uses highly accurate tools that are regularly monitored for quality control by U.S. EPA. Tools remain accurate at all levels as opposed to personal sensors like Purple Air, which overestimate (especially at AQI of 150 or higher)
- Although AirNow is relied on by many jurisdictions, please consult with your local air district about resources school districts can use that will best represent local air quality.

About Masks:

- When air is unhealthy, the best option is to reduce physical activity and stay indoors with windows/doors closed. If indoor temperature is high, get to a location with clean filtered air such as a public library, shopping mall or other building with heating, ventilation, and air conditioning (HVAC) system filtration.
- Masks have limitations. Surgical gauze masks provide no protection from smoke. N95 respirator masks are designed for professional use by trained adults and are not intended for children. Therefore, masks are not recommended for children by air quality districts/public health agencies.
- N95 masks require a perfect seal to be effective. If these masks are not fitted correctly, they will provide little if any protection.
- Masks can exacerbate breathing difficulty for sensitive breathers or potentially cause deeper breathing, which draws particulates deeper into the lungs if they are not fitted correctly.
- Masks must be kept clean and replaced frequently to be effective. If a mask is used, please refer to the mask manufacturer's recommendations on cleaning and replacement intervals.

Recommendations for Ensuring Cleaner Air at School:

- Install and maintain HVAC air conditioning system with medium or high-efficiency filtration. Install high efficiency particulate air (HEPA) filters if possible. See below for U.S. EPA recommendations for air filtration.
  https://www3.epa.gov/airnow/smoke_fires/indoor-air-filtration-factsheet-508.pdf
- Install portable HEPA filters in classrooms where possible.
  Approved filters: https://www.arb.ca.gov/research/indoor/aircleaners/certified.htm
- Be sure that portable filters are sized correctly for the room.
- Ensure doors and windows are sealed tightly. Minimize air movement in and out of room.