

*Assembly Bill 661 (McCarty, Chapter 392, Statutes of
2019) Report to the Legislature on*

**California Wildfire Smoke
Emergency Response Programs**



2023

Document Availability

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Acknowledgments

This report was authored by staff in the Research Division at California Air Resources Board (CARB) in consultation with other divisions at CARB and other agencies and organizations:

- California Air Resources Board: Executive Office, Office of the Legislative Affairs, Office of Communications, Office of Community Air Protection, Research Division, Monitoring and Laboratory Division, Air Quality Planning and Standards Division
- California Department of Public Health
- California Air Pollution Control Officers Association
- California Air Pollution Control Districts
- California Air Quality Management Districts

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Executive Summary

The smoke from wildfires has become a serious health concern for the people of California. Wildfire smoke contains a complex mixture of harmful air pollutants, including fine particles and cancer-causing substances, that can aggravate existing health problems and increase the risk of a heart attack or stroke. Climate change, including increasing temperatures and drought conditions, is leading to increased frequency and intensity of wildfires and related health impacts from smoke exposure. The increase in the intensity of wildfire events and smoke exposure in California elevates the importance of work by State and local agencies and organizations, together with federal partners, to continue to develop and improve wildfire smoke emergency plans with coordinated responses to wildfire smoke emergencies.

Assembly Bill (AB) 661 (McCarty, Chapter 392, Statutes of 2019) requires the California Air Resources Board (CARB) to develop a report to do the following: 1) summarize existing wildfire smoke air pollution emergency response programs in the State, including identification of best practices, and 2) identify local air districts that are expected to be regularly and significantly impacted by wildfire smoke and could better serve the needs of their local communities related to wildfire smoke air pollution response, including implementation of best practices with additional State funding. Pursuant to AB 661, this report investigates current programs and best practices for wildfire smoke responses in the State, estimates smoke burdens from wildfires, and includes recommendations for program areas that would benefit from additional State funding.

CARB investigated district-level smoke burdens over the past ten years (from 2011 to 2021) using a comprehensive set of satellite-based smoke observation data and found that population exposure to wildfire smoke increased during this period. CARB used two metrics for this analysis, the average number of smoke days and the average person-days of smoke exposure. The average number of smoke days, greater than $5 \mu\text{g}/\text{m}^3$ of fine particulate matter ($\text{PM}_{2.5}$) from wildfire smoke, experienced by the California population increased steadily from four days in 2011 to 68 days in 2021. The number of smoke days exceeding $5 \mu\text{g}/\text{m}^3$ of $\text{PM}_{2.5}$ from wildfires ranged from 49 to 83 days per year among the top ten air districts with the highest number of smoke days. Air districts in the Northern California area had the highest number of smoke days compared to other areas of the State. CARB also analyzed the number of people in the State who were under smoke plumes each year from 2011 to 2021. In this analysis of smoke exposure days, CARB found that air districts with the highest levels of population smoke exposure were those with the largest population. The South Coast Air Quality Management District (AQMD), the most populous district in the State, experienced the highest smoke burden on a population exposure basis and was followed by the Bay Area AQMD and the San Joaquin Valley Air Pollution Control District (APCD). Combining these metrics, CARB categorized air districts in California by high, medium, and low smoke burden areas in Table 3.

This report summarizes current programs for wildfire smoke preparedness and provides best practice recommendations for wildfire preparation and response in Table ES-1. These

best practices include actions to ensure wildfire smoke readiness before wildfire season; addressing resources and tools for providing easily accessible and timely wildfire and air quality monitoring information to the public; supporting public outreach, including targeted outreach and assistance to vulnerable populations; providing public access to clean air spaces with updated air filtration; and establishing protocols for promoting collaboration between federal, State, and local agencies.

Along with identifying best practices for air districts, this report also finds that additional funding resources, as they become available, can be used by air districts to continue to implement these practices. Key areas recommended for consideration of additional funding include ongoing wildfire preparedness and response operations, obtaining and deploying low-cost air sensors, outreach to vulnerable populations, and increasing access to cleaner air spaces through the establishment of clean air centers and distribution of residential air cleaning devices in vulnerable communities.

As California is expected to continue to experience an unprecedented level of wildfires in the foreseeable future, it is extremely important for public agencies to inform and assist members of the public to better prepare for wildfire smoke events. State and local agencies and air districts already provide important expertise, tools, and assistance in protecting public health from exposure to wildfire smoke through multiple programs, as outlined in this report. While a strong commitment exists to wildfire smoke outreach and response efforts, increasing wildfire events will require continued focus on the implementation of best practices. Additional funding and resources could support and improve existing efforts and support State and local agency work on best practices for wildfire smoke incidents and emergency response.

Table ES-1. Summary of Recommended Best Practices for Wildfire Smoke Emergencies for Local Air Districts

Best Practice	Description
Wildfire Smoke Readiness	<p>Prior to wildfire season, prepare public outreach and engagement plans for smoke events and deploy smoke monitoring equipment for updated air quality information. Establish or reconvene a workgroup consisting of staff from air quality and other key agencies, including emergency response, monitoring, health, and public information staff.</p> <ul style="list-style-type: none"> • Review and enhance partnerships with federal, State, and local agencies • Review and enhance ongoing regular conversations with school districts and county offices of education • Work with community organizations and local healthcare providers • Review and update information dissemination channels
Wildfire and Air Quality Monitoring Information	<p>Assess and update existing resources and tools for collecting and compiling timely wildfire air quality monitoring information to the public. Develop a work plan for improving access to this information.</p> <ul style="list-style-type: none"> • Enhance monitoring capacity to cover the entire district through additional sensors and a wider range of locations • Focus monitoring on PM_{2.5} concentrations from wildfire smoke • Train staff in the use and operation of CARB’s portable air monitors and sensors
Public Outreach for Community Health Protection	<p>Provide the public and vulnerable populations with information on how to protect themselves from wildfire smoke emergencies.</p> <ul style="list-style-type: none"> • Educate the general public on U.S. Environmental Protection Agency’s (EPA) AirNow Fire and Smoke Map and CARB’s California Smoke Spotter app

- Partner with community organizations and local health departments and clinics
- Conduct public outreach through diverse channels
- Prepare multilingual resources
- Conduct targeted outreach to avoid missing populations uncovered by common channels
- Consider a centralized website or clearinghouse for wildfire smoke information, including the up-to-date list of Clean Air Centers

Create cleaner air spaces by informing the public how to create a clean air space at home, establishing community clean air centers, and distributing portable air cleaners to vulnerable populations.

Access to Cleaner Air Spaces

- Identify facilities that can serve as clean air centers or emergency evacuation centers in coordination with local agencies
- Promote the importance of creating a clean air space at home
- Keep a pool of portable air cleaners to be deployed to temporary clean air centers
- Distribute or loan portable air cleaners to vulnerable populations
- Work with local and State agencies as appropriate

Interagency Collaboration

During wildfire season, communicate and coordinate regularly with federal, State, and local agencies

- Participate in ongoing coordination efforts, including the 1300/1400 Interagency Smoke Calls organized by CARB's Modeling and Meteorology Branch
- Work with county health departments to coordinate public health messaging and recommend health-protective actions

Introduction

Record-setting wildfires have affected human health, causing major damage to properties, land, and ecosystems in California. Climate change is increasing the frequency and intensity of wildfires and this trend is expected to continue as California experiences increasing temperatures, longer fire seasons, and unprecedented severe drought conditions.¹ In addition to burning natural fuels in forests and other wildlands, wildfires in urban areas generate additional air pollutants from the combustion of structures, vehicles, and other non-vegetative sources. As a result, wildfire smoke emissions consist of a complex mixture of hazardous air pollutants such as particulate matter, ozone, volatile organic compounds, metals, oxides of nitrogen, and greenhouse gases that impact public health. As wildfire threats increase, emergency response programs are critical to assist the public during wildfire events and reduce public health impacts from smoke exposure.

Pursuant to AB 661 (McCarty, Chapter 392, Statutes of 2019), CARB staff have prepared this report to provide an overview of wildfire emergency response programs, summarize best practices, and identify areas where additional support is needed at the State and local levels. Complementing existing guidelines, this report provides a summary of the current wildfire smoke response activities in the State and discusses practices that should be implemented with greatly needed additional State funding to further reduce the risk of wildfire smoke and to respond more effectively to wildfire smoke emergencies. In developing this report, CARB invited air districts to participate in surveys or interviews to contribute information on wildfire smoke emergency response programs and incorporated their responses into this document.

Poor air quality resulting from more frequent and intense wildfires poses a wide range of serious public health concerns. Fine particulate matter (PM_{2.5}), a major component of wildfire smoke, is particularly concerning as it poses a wide range of serious public health risks. PM_{2.5} is strongly associated with increased mortality from heart and lung injury. It is also known to increase asthma and other respiratory diseases, emergency room visits, and hospital admissions. Wildfire smoke can also cause negative mental health outcomes and increase psychological stress. Recent studies suggest that health effects from wildfire smoke could be worse than those from fine particles from other sources.

In recent years, wildfire smoke has accounted for up to half of the annual ambient PM_{2.5} in many regions of California,² and it is important that State and local agencies protect members of the public from this increasing threat. Significant wildfire smoke events can

¹ Williams, A. Park, Edward R. Cook, Jason E. Smerdon, Benjamin I. Cook, John T. Abatzoglou, Kasey Bolles, Seung H. Baek, Andrew M. Badger, and Ben Livneh. "Large Contribution from Anthropogenic Warming to an Emerging North American Megadrought." *Science* 368, no. 6488 (April 17, 2020): 314-18. <https://doi.org/10.1126/science.aaz9600>.

² Burke, Marshall, Anne Driscoll, Sam Heft-Neal, Jiani Xue, Jennifer Burney, and Michael Wara. "The Changing Risk and Burden of Wildfire in the United States." *Proceedings of the National Academy of Sciences* 118, no. 2 (January 12, 2021). <https://doi.org/10.1073/pnas.2011048118>.

occur without warning, making it challenging to respond to them, since they involve large amounts of biomass fuels, complex combustion processes, and changing meteorological conditions over large geographical areas. In California, many governmental agencies at the federal, State, tribal, and local levels are involved in responding to these complex smoke episodes.

State agencies, including CARB and the California Department of Public Health (CDPH), work together with local agencies, including California's air districts and county public health departments to provide advice and assistance in protecting communities from wildfire smoke. Local air districts play an important role in a variety of responses such as providing regional air quality information from air quality monitoring and modeling, informing the public with information on how to protect themselves from wildfire smoke, and reaching out to vulnerable populations in their communities. During wildfire events, air districts provide communities in their jurisdictions with critical information such as local air quality, activity guidelines, shelter-in-place, or evacuation recommendations, and the locations of clean air centers, which are developed in consultation and coordination with other governmental and emergency response organizations. Local health departments, in coordination with air districts, are typically responsible for creating public health advisories and evidence-based guidance for schools and the general public. Air districts also contribute to interagency collaborations by providing local expertise and experience particular to areas under their jurisdiction.

To assist officials at all levels of government, several guidance documents on wildfire smoke responses have been published in recent years. In 2019, the United States Environmental Protection Agency (U.S. EPA) published a major revision of *Wildfire Smoke: A Guide for Public Health Officials*,³ which provides comprehensive guidelines for public health officials to prepare for wildfire smoke events, communicate health risks, and take action to protect the public during wildfires. CDPH recently released updated guidelines specifically for California.⁴ These important resources for wildfire smoke responses are compiled in Appendix C.

³ U.S. EPA. "Wildfire Smoke A Guide for Public Health Officials Revised 2019." Research Triangle Park, NC: United States Environmental Protection Agency. Office of Air Quality Planning and Standards. Health and Environmental Impacts Division., August 2019. <https://www.airnow.gov/sites/default/files/2021-05/wildfire-smoke-guide-revised-2019.pdf>.

⁴ CDPH. "Wildfire Smoke Considerations for California's Public Health Officials." California Department of Public Health, August 2022. https://www.cdph.ca.gov/Programs/EPO/CDPH%20Document%20Library/EOM%20Documents/Wildfire-Smoke-Considerations-CA-PHO_08-2022.pdf.

Wildfire Smoke Emergency Response Programs in California

There are many federal, State, local agencies, tribes, and non-governmental entities involved in responding to wildfire smoke emergencies in California. A summary of their roles and partnerships and collaborations among them is provided in this chapter.

Overview

Wildfires have become a major public health risk in California in recent years. Communities throughout California often face severe wildfire smoke events for extended periods of several days or even weeks. Due to hot, dry conditions and other climate change related factors, the frequency and magnitude of wildfires are expected to increase substantially into the foreseeable future.

In California, federal, State, tribal, and local government organizations are actively involved in addressing wildfire smoke incidents. As the nature of wildfire smoke emergencies is highly uncertain and often requires sophisticated expertise and resources to understand and respond to such emergencies, agencies at different levels of government work together to be prepared for such events to provide the public with relevant information, communicate health risks, and take measures to protect the public.

Federal and State agencies provide information, resources, and support to local government agencies, tribal communities, and members of the public to address wildfire smoke emergencies. Federal agencies lead inter-state and interagency collaborations dedicated to wildfire issues, provide air quality information collected throughout the country, and publish guidelines for the public as well as health officials. California State agencies run diverse programs and multiagency collaborations to provide local air districts and the public with information on air quality and meteorology related to wildfires, assist local air districts in setting up additional air quality monitoring equipment when needed, and set up and operate evacuation shelters for wildfire smoke emergencies. Some California agencies operate grant programs to build cleaner air centers and improve air filtration at schools and other public buildings. More information is included below, and a list of agencies is included in Figure 1.

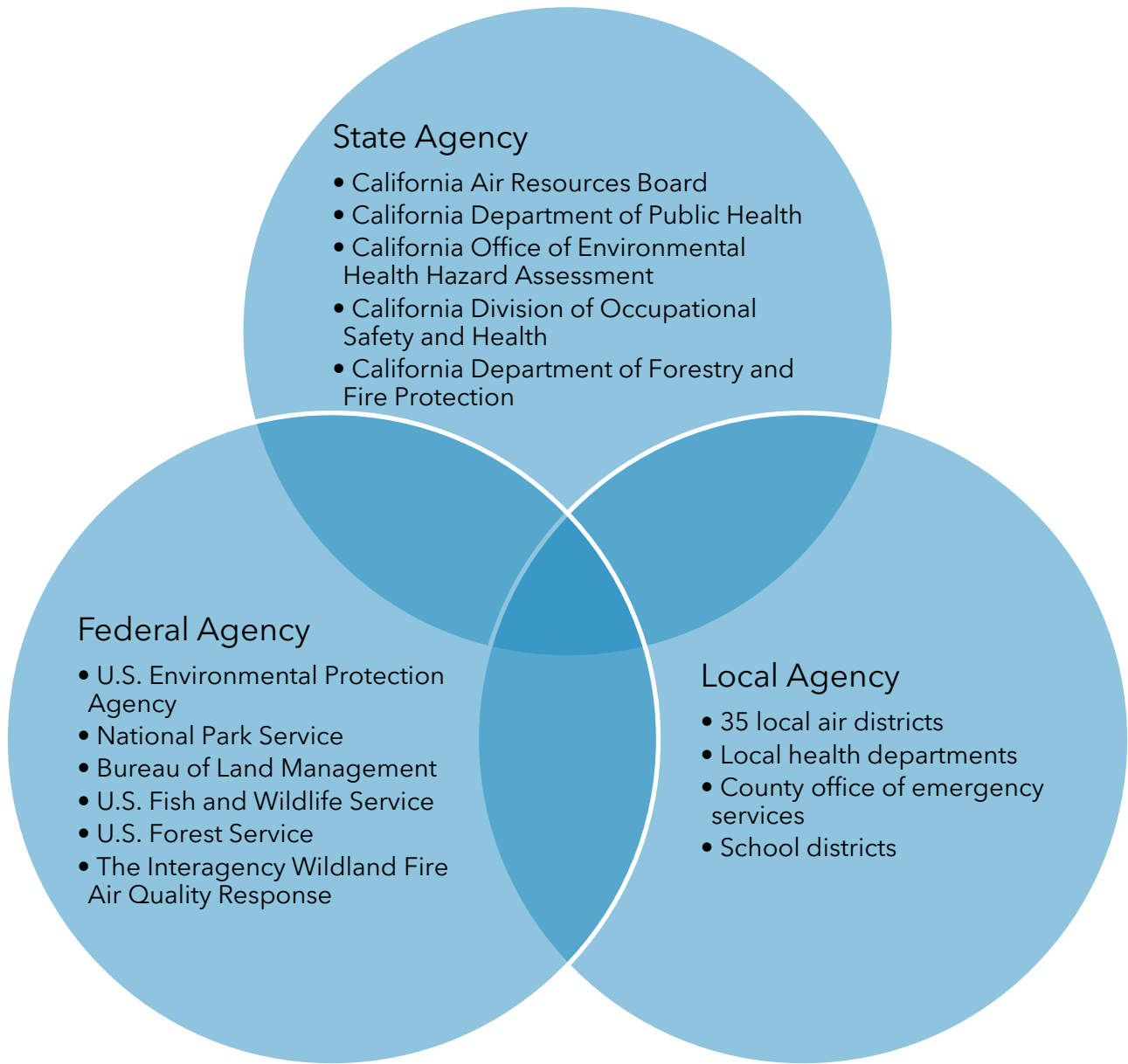


Figure 1. Key wildfire smoke response organizations active in California

California’s 35 air districts are at the forefront of protecting people from exposure to wildfire smoke. They often work with other federal, State, and local government entities, school districts, and members of the public to enhance their readiness to respond to wildfire smoke emergencies. The scope of air district programs varies tremendously since they have a wide range of budgets and governance depending on the jurisdiction, geography, population, pollution sources, and meteorological conditions. Therefore, it is not surprising that there is a varying array of strategies and programs for reporting and managing wildfire smoke impacts that are employed in different regions in the State.

Federal and State Agencies

Many federal and State agencies are involved in wildfire smoke response as wildfire smoke affects areas under both federal and State jurisdictions. They also provide local agencies with advanced tools and resources for decision-making during smoke emergencies.

U.S. EPA provides various tools to the public as well as State and local agencies. AirNow,⁵ probably the most visible and most frequently used website for up-to-date information about fire and smoke, is developed and maintained by U.S. EPA in collaboration with other agencies and serves as a one-stop source for air quality data for the public as well as State and local governments. AirNow includes the Fire and Smoke Map,⁶ a tool delivering a robust set of information related to wildfires, including air quality information collected from ground-level air quality monitors, information on fire locations, burn perimeters, smoke plumes, and special statements about smoke issued by government agencies. U.S. EPA also provides guidance documents to help educate public workers and health officials, as well as the general public, about the risks of smoke exposure and proper actions to take to minimize their exposure.

The U.S. Forest Service, National Park Service, Bureau of Land Management, and U.S. Fish and Wildlife Service are actively engaged in wildfire suppression and containment as well as resource management, air quality modeling, and smoke management.

The Interagency Wildland Fire Air Quality Response Program (IWFAQRP)⁷ is a federal interagency program that provides important resources in wildfire smoke responses. They support wildfire-specific air quality monitoring and modeling and coordinate collaborations among wildfire-related partners at federal, State, and local agencies. Air Resource Advisors (ARA) are dispatched by the program to wildfire incidents as part of an incident management team. They provide advanced monitoring and modeling for wildfire incidents and work with State and local agencies to prepare public messaging.

The California Air Resources Board (CARB) provides air quality modeling and monitoring information, public outreach and messaging, and State-level wildfire smoke response resources to local agencies and administers Clean Air Centers programs. During emergencies, CARB provides air pollution monitoring, sampling, analysis, and dispersion modeling to local agencies such as local air districts, public or environmental health departments, and fire departments.⁸ CARB maintains and funds six regional caches of air monitoring equipment that can be used by trained air district staff during smoke events. CARB coordinates the 1300/1400 Interagency Smoke Calls to share monitoring and modeling and wildfire reports and coordinate smoke messaging with air districts, Air

⁵ U.S. EPA. AirNow. <https://airnow.gov/>

⁶ U.S. EPA. Fire and Smoke Map v2.0. <https://fire.airnow.gov/>

⁷ Interagency Wildland Fire Air Quality Response Program. <https://www.wildlandfiresmoke.us/>

⁸ CARB. Requesting CARB Emergency Air Monitoring Support Services. <https://ww2.arb.ca.gov/requesting-carb-emergency-air-monitoring-support-services>

Resource Advisors, and federal land managers. CARB runs a social media and web campaign called Smoke Ready California⁹ to provide easy-to-understand, actionable steps members of the public can take to protect themselves from wildfire smoke. Developed in collaboration with air districts and other State and federal agencies, the campaign materials have been widely circulated to enhance smoke readiness in the State. CARB also works closely with local air districts on exceptional event analysis for wildfire smoke events to inform attainment designations for the National Ambient Air Quality Standards (NAAQS).

The California Department of Public Health (CDPH) both investigates the health impacts related to wildfire smoke exposure and provides information on issues of concern from wildfire exposures. CDPH provides information on improving wildfire smoke emergency preparedness to the public and guidance for public health officials in California⁴. The guidance document covers such topics as sources of air quality information, wildfire smoke and health, and how to reduce smoke exposure by sheltering indoors and reducing physical activity. The wildfire smoke guide also provides information about respirators and their use, with a separate discussion on children's respirator use. CDPH provides information online on ongoing research on many different aspects of wildfire, including the health impacts, sampling and monitoring, studies of the different components of wildfire, and studies of the effectiveness of mitigation methods.¹⁰ The CDPH Office of Communications also provides additional social media resources on their website.¹¹

The California Office of Environmental Health Hazard Assessment (OEHHA) provides several resources to help Californians understand the health risks of exposure to wildfire smoke. For instance, the "Guidance for Schools During Wildfire Smoke Events"¹² includes recommendations to assist schools in decisions to help reduce the impacts of exposure to wildfire smoke and protect students' health. OEHHA used science-based measurements to develop a climate change indicator¹³ reflecting the area burned by wildfires across the State from 1950 to 2017. This indicator shows the impact of climate change in the State through an increasing trend of the number of acres burned by wildfires in California in tandem with rising temperatures. OEHHA also conducts health studies to investigate the associations between wildfire smoke and health effects (e.g., emergency department visits, hospital visits for respiratory diseases, and mortality).

⁹ CARB. Protecting Yourself from Wildfire Smoke. <https://ww2.arb.ca.gov/protecting-yourself-wildfire-smoke>. Accessed Feb 11, 2022.

¹⁰ CDPH. Emergency Preparedness Office. Wildfires. <https://www.cdph.ca.gov/Programs/EPO/Pages/Wildfire%20Pages/Wildfires--.aspx>. Accessed Feb 11, 2022.

¹¹ CDPH. Wildfire Safety Tips. <https://www.cdph.ca.gov/Programs/OPA/Pages/Communications-Toolkits/Wildfires.aspx>. Accessed Feb 11, 2022.

¹² OEHHA. Guidance for Schools During Wildfire Smoke Events. <https://oehha.ca.gov/media/downloads/air/fact-sheet/wildfiresmokeguideschoolsada.pdf>. Accessed Feb 11, 2022.

¹³ OEHHA. 2018 Indicators of Climate Change in California - Wildfire. <https://oehha.ca.gov/epic/impacts-biological-systems/wildfires>. Accessed Feb 11, 2022.

The California Division of Occupational Safety and Health (Cal/OSHA) plays a crucial role in protecting workers from the health risks associated with wildfire smoke emergencies in California. The agency sets guidelines and standards for employers to protect workers from exposure to wildfire smoke. Under California Code of Regulations, Title 8, Section 5141.1, Cal/OSHA requires employers to identify employees' exposure to wildfire smoke, communicate the hazards of wildfire smoke in a language and manner that employees can easily understand, provide employees with training and instruction on the dangers of wildfire smoke, and implement measures to control employee exposure to wildfire smoke.

The California Department of Forestry and Fire Protection (CAL FIRE) plays a crucial role in responding to wildfire smoke emergencies in California. One of its primary responsibilities is managing and suppressing wildfires. During wildfire events, CAL FIRE works to contain and control the fires with the goal of minimizing the amount of smoke and pollutants released into the air. The agency also works closely with air districts to monitor air quality and provide information to the public about air quality conditions. In addition to managing wildfires and monitoring air quality, CAL FIRE provides guidance and support to communities affected by wildfire smoke emergencies. This includes providing information and resources on how to reduce exposure to smoke and protect public health during wildfire events.

Local Agencies

California's local agencies include air districts, local or county health departments, and school districts, which vary greatly in size and populace depending on the location. Often these three agencies within a region coordinate and assist each other during wildfire smoke events.

Air districts address wildfire smoke episodes through diverse practices and programs. In general, air districts work with local agencies, CARB, and the public to enhance their wildfire smoke readiness during non-fire seasons, deploy and maintain air quality monitoring equipment, provide air quality and public health information during wildfire smoke events, conduct public outreach through various media channels, and coordinate with other local, State, and federal organizations. Air districts, supported by CARB, monitor the impact of wildfire smoke on the attainment status of National Ambient Air Quality Standards (NAAQS) by gathering data on wildfire smoke events and working with CARB to analyze the data and document exceptional events through the U.S. EPA exceptional event process. During wildfire episodes, they inform the public about smoke incidents and associated air quality issues. They also issue health advisories—often in partnership with local and State health officials. Air districts also permit prescribed burns which are an important management tool to avoid catastrophic wildfires and minimize public health impacts of wildfire smoke.

The 35 air districts in California are displayed on a map in Figure D-1. Although they all strive to protect members of the public from air pollution, the strategy of each district and their scope of work vary substantially as their regulatory roles, budget, and staff resources

can vary widely due to factors such as differences in pollution sources, demographics, natural environment, and wildfire risks.

Local or county health departments, often in collaboration with air districts, inform the public of health risks and recommend protective actions by issuing health advisories during wildfire events. They have the authority to make health action-based decisions such as shelter-in-place and evacuation. Many local agencies are partnering with air districts to sponsor Clean Air Centers funded by AB 836 (Wicks, Chapter 393, Statutes of 2019).

School districts, under guidance from their air district and health department, make decisions on school outdoor activities during wildfire events based on student health risks. Some schools partner with air districts to sponsor Clean Air Centers.

Wildfire Impacts on Vulnerable Populations

Not all people are equally affected by wildfire smoke events. Certain groups such as low-income communities and communities of color, children, seniors, and those with existing health conditions or those with limited resources to properly respond to smoke events are more vulnerable than others to wildfire smoke exposure. Vulnerable populations include communities in areas designated by CARB's AB 617 Community Air Protection Program and areas included as low-income or vulnerable communities under Senate Bill (SB) 535 (De León, Chapter 830, Statutes of 2012) criteria, for example.¹⁴ CalEnviroScreen¹⁵ also identifies vulnerable communities in California using indicators of pollution burden, population health, and socioeconomic factors. Key measures to assist vulnerable communities can include establishing communication channels to reach out to vulnerable populations with information and resources, working with healthcare providers and community organizations to help reduce smoke exposure in vulnerable communities, and providing multilingual resources. Operating dedicated air quality monitoring equipment in vulnerable communities can provide quick and accurate air quality information for air districts and the public to make informed decisions. Providing portable air cleaners to vulnerable communities can support emergency preparedness by creating cleaner air spaces in residents' homes.

¹⁴ CARB. Community Air Protection Program. <https://ww2.arb.ca.gov/capp>

¹⁵ CalEnviroScreen, <https://oehha.ca.gov/calenviroscreen>

Summary of Air District Emergency Response Programs and Practices

Current practices of multiple air districts are identified and summarized in this chapter. They were determined through in-depth interviews, responses to online surveys sent to all air districts, and a review of publicly available documents and resources. They are organized by five subjects: wildfire smoke readiness, air quality monitoring and modeling, public outreach, interagency collaborations, and cleaner air spaces.

For this report, air districts are categorized as large, medium, and small. Large air districts are those located in highly urban areas with large populations. Medium air districts are referred to as those that are smaller than large districts but have dedicated staff for wildfire smoke events. Small districts indicate those that operate a small office of up to 10 staff and are located mostly in rural areas with sparsely distributed populations.

Following are the key areas identified by air districts through either interviews or survey responses.

Wildfire Smoke Readiness

It is important for members of the public and other entities in the air district to be knowledgeable about what to do before, during, and after wildfire smoke events. Air districts work to enhance such smoke readiness in their jurisdictions, especially during non-smoke seasons, through the following activities.

- **Developing wildfire smoke activity guidelines:** Wildfire activity guidelines provide recommendations on what activities, if any, should be restricted based on the air quality. For example, when the Air Quality Index (AQI) is at unhealthy levels (AQI > 150), all residents are asked to stay indoors or reduce outdoor activities. At lower levels (100 < AQI < 150), sensitive populations are advised to stay indoors. Districts and California Air Pollution Control Officers Association (CAPCOA) publish and update guidelines for schools and the public, which are adapted from the U.S. EPA's activity guides¹⁶ to reflect local conditions and needs. See Figure 2 for guidelines developed by Sacramento Metropolitan Air Quality Management District.

¹⁶ U.S. EPA, Activity Guides Publications, <https://www.airnow.gov/publications/activity-guides-publications/>. Accessed on January 24, 2022.

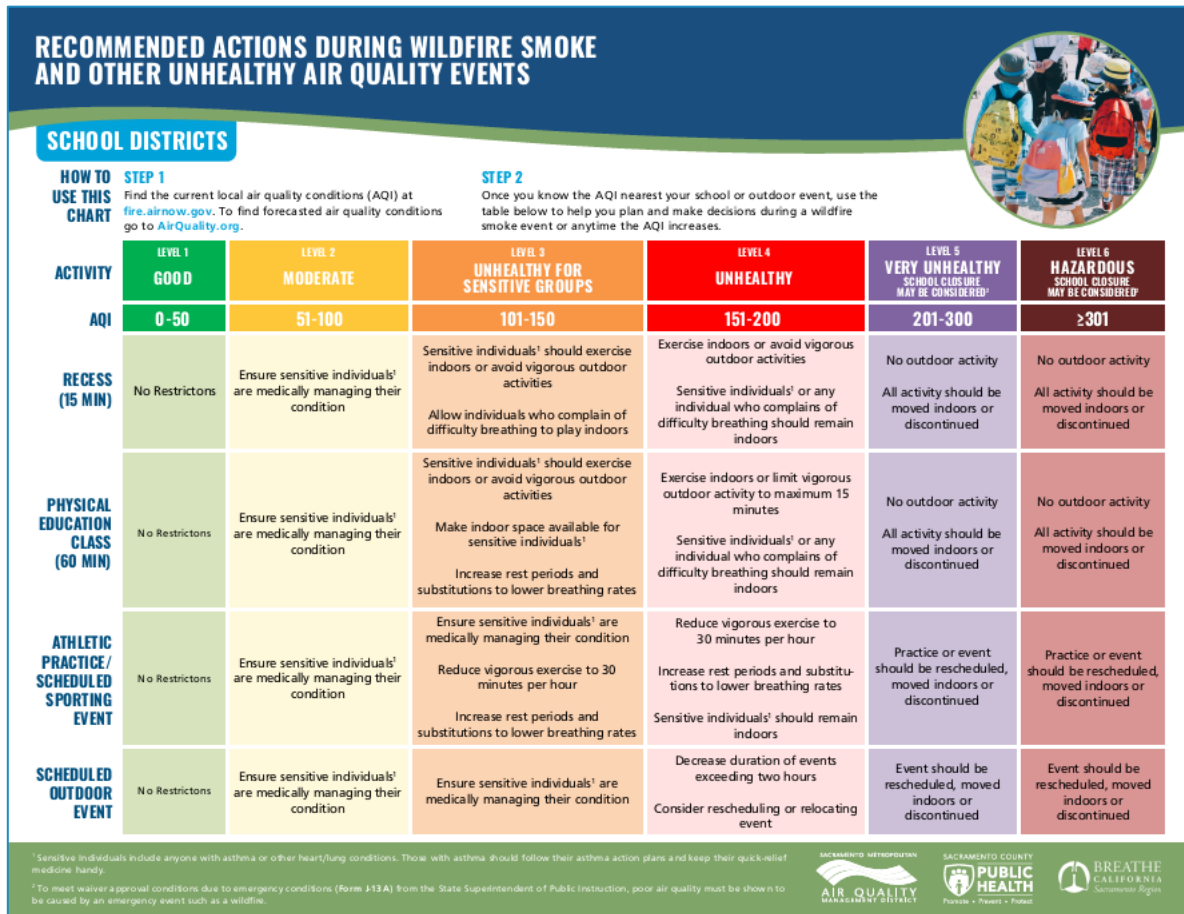


Figure 2. Example of activity guideline for schools (Courtesy of Sacramento Metropolitan AQMD www.airquality.org)

- Collaborating with school districts and superintendents:** Some air districts regularly have meetings with school administrators to ensure that they are aware of any changes in air district guidelines and programs as well as current technology and information that are available. These meetings help guide school districts on how schools should manage wildfire smoke events by providing activity guidelines for the different levels of air quality and educating school districts on how to use new tools for decision-making. Figure 3 shows an example of guidance for schools during wildfire smoke events from the Sacramento Metropolitan AQMD.

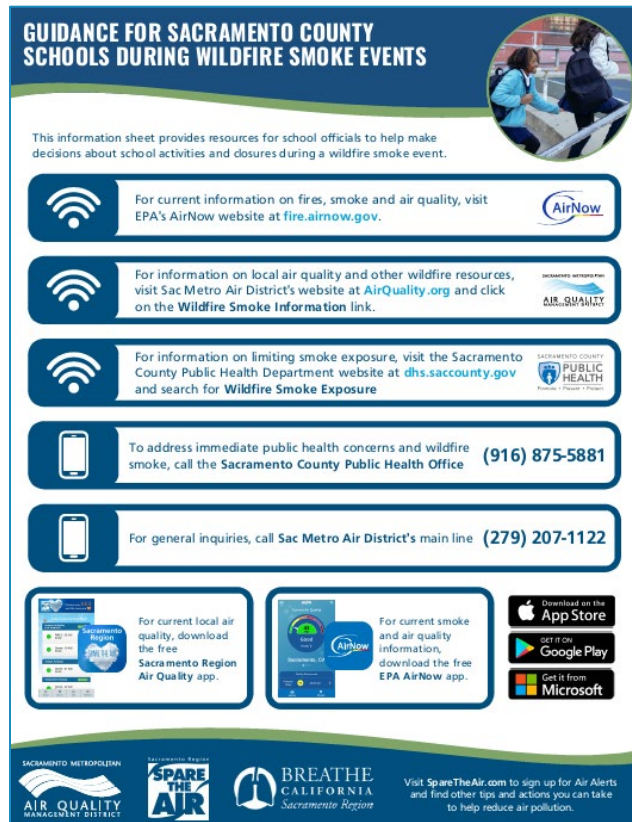


Figure 3. Example of a guidance document for schools during wildfire smoke events (Courtesy of Sacramento Metropolitan AQMD www.airquality.org)

- **Preparing air monitoring equipment before the start of fire season:** Many districts have additional monitoring equipment that can be deployed to areas where air pollution is a concern to provide timely air quality information to the public. The equipment is purchased, calibrated, and maintained for accuracy in order to be ready for deployment before wildfire season. Some instruments, such as the Environmental Beta-Attenuation Mass Monitor, are portable and provide good measurement accuracy, which is comparable to U.S. EPA's regulatory methods for PM_{2.5} and PM₁₀. The districts can also be provided with additional air monitoring equipment through CARB's Incident Air Monitoring Section. Trained air district staff may use portable air monitors borrowed from one of the six CARB equipment storage caches. The equipment storage caches, which CARB replenishes and maintains, are strategically placed throughout the State and have full suites of response ready equipment, sensors and supplies which districts and responding partners can access and deploy during wildfire events to measure and report concentrations of smoke. In addition to regulatory quality portable instruments, low-cost sensors such as the PurpleAir or Clarity Node are becoming more commonly used to improve the granularity of particulate matter monitoring networks. To improve the accuracy of data generated

using low-cost sensors, a U.S. EPA correction factor may be applied. Typically, these devices supplement existing monitoring conducted through the Federal monitoring network often coordinated with the local air district. This example in Figure 4 below demonstrates how a community can tap into a variety of monitoring resources to better prepare for and provide information during wildfire smoke events.

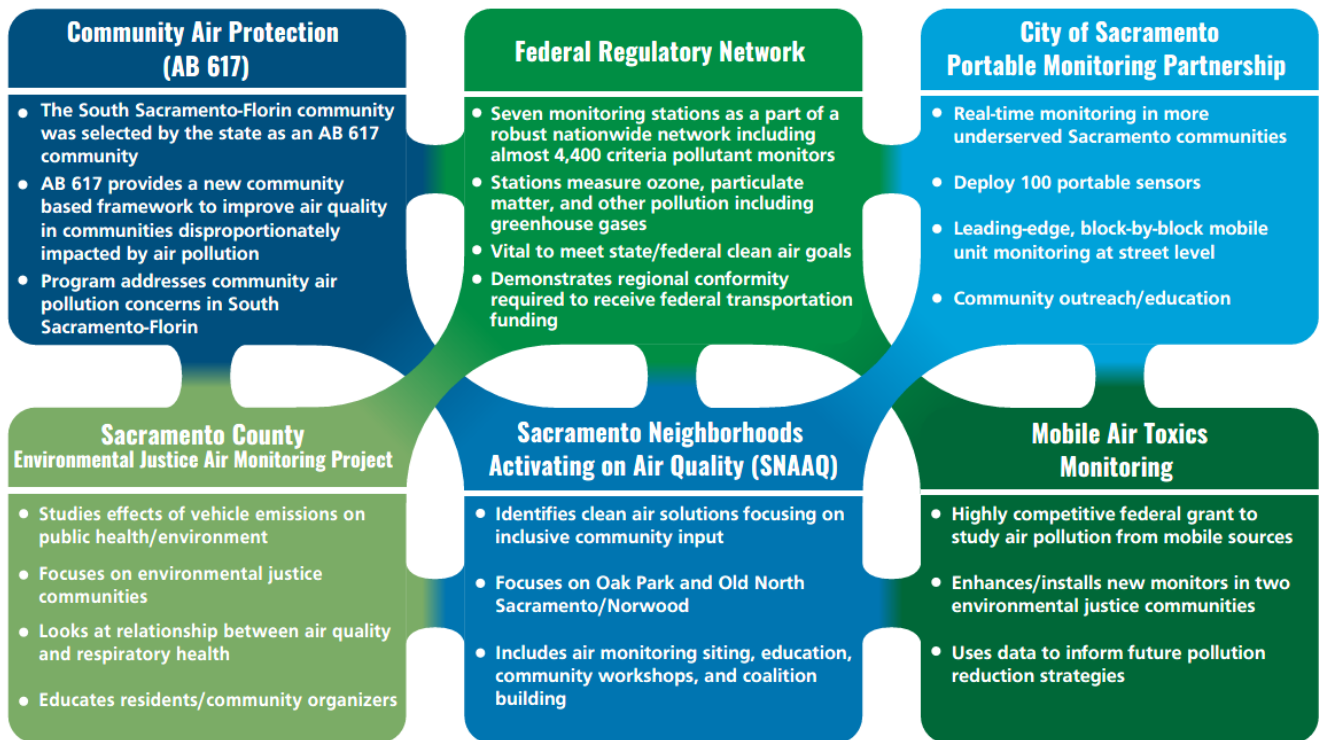


Figure 4. Multiple monitoring networks available for community smoke event preparation and response (Courtesy of Sacramento Metropolitan AQMD www.airquality.org)

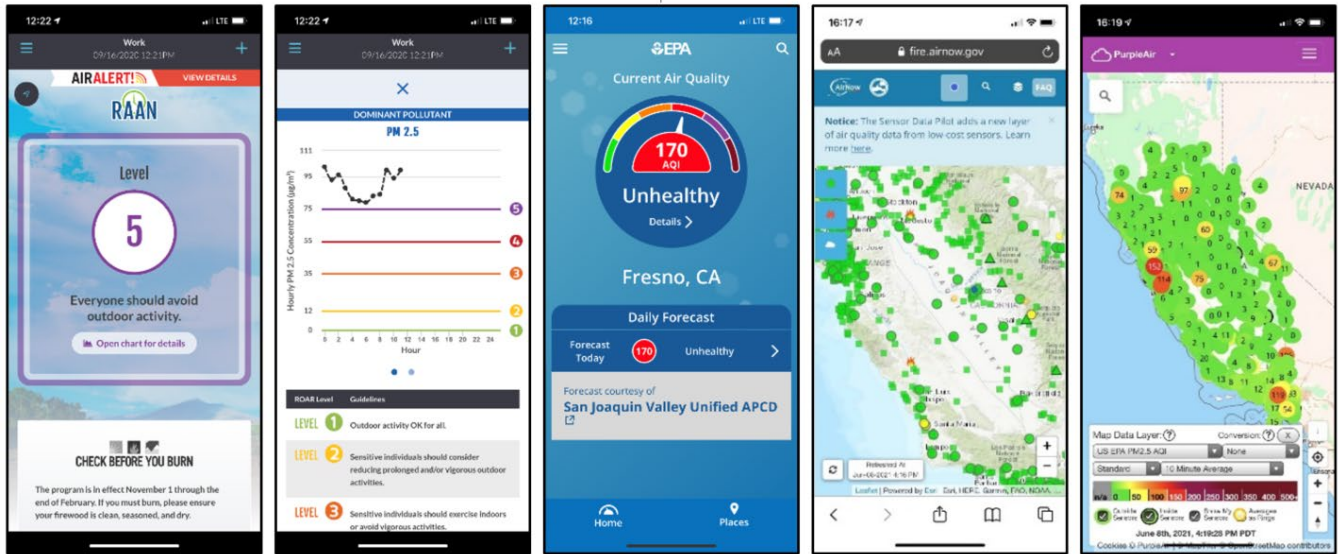


Figure 5. Examples of air quality information tools (San Joaquin Valley APCD’s Real-time Air Advisory Network, U.S. EPA’s AirNow, and Purple Air’s Real-time Map) available to the public (Courtesy of San Joaquin Valley APCD www.valleyair.org)

- Educating residents on available air quality tools:** Applications available on the web and mobile devices can provide the most updated wildfire and smoke information. Districts promote the use of the most current tools and provide educational opportunities. Examples of such tools include CARB’s Smoke Spotter application, which provides information about prescribed fires and wildfires, personalized alerts for nearby fires, and AQI data to help users make health-based decisions. There is also U.S. EPA’s AirNow mobile application, which provides real-time air quality information that the public can use to reduce smoke exposure and plan their daily activities. Another example is the San Joaquin Valley APCD’s Valley Air app, which is available in English and Spanish. This app provides hourly air quality information for the San Joaquin Valley area through the Real-time Air Advisory Network (RAAN) that is operated by the San Joaquin District. Examples of air quality information tools available to the public are illustrated in Figure 5.
- Providing guidance to residents on respiratory protection from wildfire smoke:** Wearing a properly fitted respirator can be effective in reducing personal exposure to wildfire smoke, although the public should be advised to limit outdoor activities first. Air districts, many in collaboration with their local health departments, provide resources to the public about selecting the proper respirator (e.g., N95, KN95, or P100); how to wear them; and the potential risk of wearing a respirator. U.S. EPA’s

factsheet on respirators¹⁷ provides guidelines on how to select and wear them properly. Additional information on respirator masks and protection from wildfire smoke is available on CARB's website.¹⁸

Air Quality Monitoring and Modeling

Accurate air quality information is crucial during smoke events. Air districts strive to deliver the best air quality information based on their air quality monitoring and forecasts as well as information and resources obtained from other collaborative partners. While there are differences among the monitoring equipment operated by districts, they can improve their monitoring and modeling capability before and during wildfire seasons through the following activities:

- **Deploying low-cost PM_{2.5} sensors to areas that are not covered by regulatory monitoring equipment:** The advancement of low-cost air quality PM_{2.5} sensor technology provides opportunities to build affordable air quality monitoring networks, complementing the network of regulatory monitors. They can be easily deployed wherever power and an internet connection are available. Some recent developments include low-cost sensors that run on batteries charged by a solar panel and communicate the data through a cellular network, providing much more flexibility for deployment in remote areas. Low-cost sensors are installed at schools, public facilities, and private residences. Low-cost sensor data is provided as important air quality information in the U.S. EPA's AirNow website.
- **Requesting emergency air monitoring support from CARB:** During wildfire smoke incidents, small and medium districts may not be able to support all the necessary air quality monitoring due to their limited monitoring capacity. When district-level resources are insufficient to conduct air quality monitoring during smoke events, districts may request State-level support from CARB's Incident Air Monitoring Section's Emergency Air Monitoring Support Services.¹⁹ The CARB services provide support for air quality monitoring, sampling, analysis, response coordination and dispersion modeling, including provision of air monitoring equipment. Trained district staff may deploy air monitoring equipment directly by borrowing it from one of CARB's six regional equipment storage caches. Districts reach out to CARB to better inform the public by filling in data gaps in air quality information.
- **Requesting and Utilizing Air Resources Advisors:** The Interagency Wildland Fire Air Quality Response Program (IWFAQRP), a federal interagency program, dispatches

¹⁷ U.S. EPA. 2021. Protect Your Lungs from Wildfire Smoke or Ash. EPA- 452/F-21-011.

<https://www.airnow.gov/sites/default/files/2021-12/protect-your-lungs-from-wildfire-smoke-or-ash.pdf>

¹⁸ CARB. Protecting Yourself from Wildfire Smoke. <https://ww2.arb.ca.gov/protecting-yourself-wildfire-smoke>. Accessed on January 24, 2022.

¹⁹ CARB. Requesting CARB Emergency Air Monitoring Support Services. <https://ww2.arb.ca.gov/requesting-carb-emergency-air-monitoring-support-services>. Accessed on January 24, 2022.

wildfire smoke specialists known as Air Resources Advisors (ARA) to a wildfire incident. ARAs have access to more advanced information on air quality status and forecasts in addition to their general expertise in dealing with wildfire emergencies. By working closely with an ARA, air districts gain access to the information relevant to their wildfire smoke response. Advanced atmospheric modeling and forecasts from ARAs are especially useful to small and medium districts with limited resources to do such modeling by themselves.

Public Outreach

Air districts conduct public outreach to inform the public about wildfire smoke impacts and to provide district guidance on air quality and outdoor activities. Districts have employed the following practices to enhance the effectiveness of their public outreach efforts:

- ***Developing and disseminating air quality and health advisories in a timely manner:*** Once a smoke event reaches unhealthy levels, many districts develop public air quality advisories. Advisories can include the current air quality conditions and future forecasts. Working with county health officers, districts also provide guidance on how to reduce exposure to wildfire smoke. Medium and large districts usually prepare advisories in multiple languages. Districts often have advisory templates so that they are created quickly with a minimal review period. Example advisories from San Joaquin Valley APCD are presented in Figure 6.
- ***Working with local offices of the National Weather Service (NWS) to disseminate air quality and health advisories:*** Air districts can work directly with their local NWS office to coordinate the dissemination of air quality and health advisories. Utilizing the NWS network can help to reach a wider audience as the information on the network is disseminated through various channels, including social media, email, and mobile apps.
- ***Utilizing multiple media channels for public outreach:*** Districts rely on multiple media channels such as websites, mailing lists, social network services, radios, TVs, phone alerts, text messages, and various print media to inform the public about smoke events. They maintain a list of stakeholder contacts for media, government agencies, businesses, health care providers, community organizations, schools, and children's activity organizations. Using a variety of communication media, air districts deliver critical messages and information to members of the public.

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

NEWS Release **HEALTHY AIR LIVING**

www.valleyair.org 24hr Media Cell Phone (559) 309-3336

For immediate release 10-04-2021

Attn: Local news, weather, health and assignment editors

Media Contact:
Heather Hanks (559) 994-7591
Spanish Media Contact:
Maricela Velasquez (559) 230-5849

Update: The Air quality alert (detailed below) has been extended through Thursday, 10/07/21 at 11:00am

Air Quality Alert Due to Wildfire Smoke
KNP Complex and Windy Fire Send Smoke into the Valley

Smoke infiltration from the Windy and KNP Complex fires in Tulare County combined with high pressure and poor dispersion have prompted air quality officials in the San Joaquin Valley to issue an Air Quality Alert. Smoke is expected to continue to impact the San Joaquin Valley through **Thursday, October 7**, when a low-pressure system moving over the Valley is forecast to improve dispersion. The District warns residents being impacted by smoke to remain indoors to reduce their exposure to particulate matter (PM) emissions.

Particulate matter can trigger asthma attacks, aggravate chronic bronchitis, and increase the risk of heart attack and stroke. Individuals with heart or lung disease should follow their doctors' advice for dealing with episodes of PM exposure. Those with existing respiratory conditions, including COVID-19, young children and the elderly, are especially susceptible to the health effects from this form of pollution. Residents experiencing poor air quality due to wildfire smoke should move to a filtered, air-conditioned environment with windows closed. Common cloth and paper masks being used as protection from COVID-19 may not be sufficient protection from wildfire smoke inhalation. For outdoor workers and other individuals that may not be able to remain indoors, state health authorities recommend the use of N95 facemasks as feasible.

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Comunicado de Prensa **AIRE LIMPIO. VIDA SANA**

www.valleyair.org Número de Comunicación 24hr (559) 309-3336

Para publicación inmediata 10-04-2021

Attn: Noticieros locales, clima, salud y editor de asignación

Spanish Media Contact:
Maricela Velasquez (559) 230-5849

Actualización: La alerta de la calidad del aire (detalles abajo) ha sido extendida hasta el jueves, 7 de octubre de 2021 a las 11:00am

Alerta de la Calidad del Aire Debido al Humo de los Incendios Forestales
El Incendio KNP Complex y Windy Envía Humo al Valle

Infiltración de humo de los incendios Windy y KNP Complex en el Condado de Tulare combinado con presión alta y mala dispersión ha impulsado a funcionarios de la calidad del aire en el Valle de San Joaquin a emitir una Alerta de la Calidad del Aire. Se espera que el humo continúe a impactar el Valle de San Joaquin hasta el **jueves, 7 de octubre**, cuando un sistema de presión baja que se moverá por encima del Valle es pronosticado que mejore la dispersión. El Distrito advierte a los residentes afectados por el humo que permanezcan dentro casa para reducir su exposición a las emisiones de material particulado (PM).

El material particulado puede desencadenar ataques de asma, agravar bronquitis crónica, e incrementa el riesgo de ataques de corazón y derrame cerebral. Individuos con enfermedad de corazón y pulmones deberán seguir las recomendaciones de su doctor para lidiar con episodios de exposición de PM. Residentes con condiciones respiratorias existentes, incluyendo COVID-19, niños pequeños y personas de la tercera edad, son especialmente susceptibles a los efectos de salud de esta forma de contaminación. Cualquier persona experimentando mala calidad de aire debido a el humo de incendios forestales deberían moverse a espacios cerrados, a un ambiente con aire acondicionado y filtrado con las ventanas cerradas. Las mascarillas comunes de tela y papel que los individuos están usando debido a preocupaciones del COVID-19 puede que no los proteja del humo de incendios forestales. Para los trabajadores al aire libre y otras personas que no puedan permanecer en el interior, las autoridades de salud estatales recomiendan el uso de mascarillas N95 según sea posible.

Figure 6. Examples of air district air quality and health advisories (Courtesy of San Joaquin Valley APCD www.valleyair.org)

- **Preparing multilingual resources:** To ensure language access for vulnerable populations, air districts collaborate with community organizations and local health departments or clinics to co-develop and review culturally appropriate materials and have native speakers review translated materials. Some districts also communicate with non-English speaking populations by providing materials in Spanish and other languages. Figure 7 shows an example from the San Joaquin Valley APCD. Moreover, some districts, such as the South Coast AQMD, have integrated translation tools into their online resources, making multilingual communication more efficient and accessible. This approach can save time compared to manual Spanish translation, particularly for materials that undergo frequent updates. Online translation tools also ensure that these resources are available to those who do not speak English or Spanish.
- **Improving the accessibility of outreach materials:** When creating information that the public will access, it is important to consider the devices they will use. For example, it is better to prepare online documents in a mobile-friendly format, rather than a print-friendly format such as Portable Document Format (PDF). Additionally, it is important to use a color scheme that is accessible to people with different types of color vision. This can help ensure that resources are accessible to the widest possible audience.

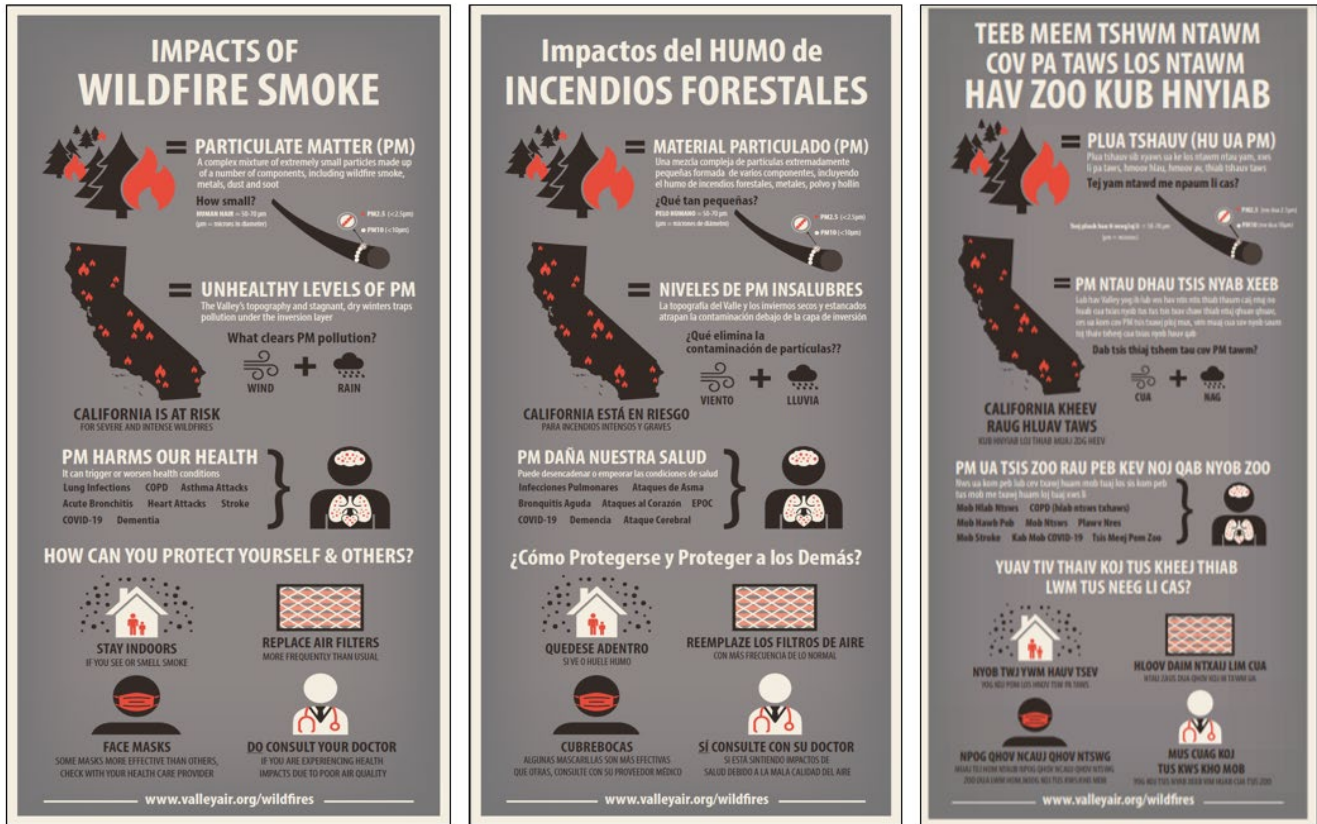


Figure 7. Examples of multilingual messaging on health impacts and protecting the public from wildfire smoke exposure (Courtesy of San Joaquin Valley APCD www.valleyair.org)

- Preparing easy-to-understand public-facing materials:** Air districts develop and disseminate infographics to raise awareness of wildfire smoke issues, including current and historical wildfires and potential health effects. Districts also guide the public to take actions to protect personal health during wildfire episodes and to minimize activities that produce additional air pollution. While large districts often develop their own resources customized to their districts, many small districts use resources created by other districts, CARB, or U.S. EPA. Examples of public-facing materials are presented in Figure 8.

Figure 8. Public facing Purifier material on what to do during a wildfire smoke event (Courtesy of South Coast AQMD www.aqmd.gov, Sacramento Metropolitan AQMD airquality.org, and Santa Barbara County APCD www.ourair.org)

- ***Making additional efforts to reach out to vulnerable populations:*** Certain populations, such as the young, the elderly, or those with respiratory diseases can be more vulnerable than others. Those who are unhoused, do not have access to transportation, or cannot afford protective measures to reduce their exposure to wildfire smoke can also be more likely impacted. People who need the most assistance during wildfire events may not have access to common media channels due to factors such as existing health conditions and under-resourced socio-economic backgrounds. Some air districts partner with community organizations and local health departments or clinics to co-develop an outreach plan since they may have trusted relationships with hard-to-reach populations. Certain air districts have established smoke alert systems that use both audio and text alerts in indigenous languages to reach farmworkers. These alerts also include information on the legal responsibilities of their employers to monitor air quality and supply personal protective equipment when needed, providing critical information for worker safety.

Interagency Collaborations

As wildfire smoke emergencies are multifaceted events and their effects often reach beyond district boundaries, air districts may not have sufficient resources and expertise to cope with major wildfire smoke events by themselves. Thus, it is important for districts to work closely with neighboring air districts and other agencies to respond to wildfire smoke events. Their coordinated efforts are described below.

- ***Participating in the 1300/1400 Interagency Smoke Calls organized by CARB's Modeling and Meteorology Branch:*** These calls occur daily during fire season. During these calls, federal, State, local and tribal government agencies share and discuss meteorology forecasting, wildfire reports from ARAs and others, and CARB air monitoring reports and requests. Participants also work together on proper messaging to the public based on the status of incidents. Districts get the latest information and report their local development.
- ***Continuing to both establish and strengthen collaborative partnerships with local government agencies and neighboring air districts:*** Air districts meet regularly with county health officers regularly to prepare for wildfire season and collaborate with them closely during wildfire smoke emergencies.

Clean Air Centers

Clean air centers are public buildings or parts of buildings that are equipped with updated air filtration so that people can reduce their exposure to wildfire smoke. CARB oversees the statewide Clean Air Centers Grant program as discussed below. Clean air centers are equipped with Heating, Ventilation, and Air Conditioning (HVAC) systems with high-efficiency filtration or portable air cleaners. During wildfire smoke emergencies, people can find respite from wildfire smoke in clean air centers and evacuation shelters. People can also prepare such a space in their private residences.

- **Identifying potential facilities for clean air centers and emergency evacuation:** Many districts identify facilities that can be operated as clean air centers or evacuation centers. Often, they work with their county health departments, county offices of emergency services, California Governor's Office of Emergency Services (Cal OES), and the American Red Cross to coordinate setting up and operating such centers. They also provide information to guide residents to provide good indoor air quality so that people can find respite from wildfire smoke at the centers during wildfire smoke emergencies.
- **Establishing clean air centers:** Under AB 836,²⁰ CARB is implementing the development of the Wildfire Smoke Clean Air Centers for Vulnerable Populations Incentive Pilot Program in coordination with local air districts. The Program is funded by \$5 million in State funds to provide a network of centers across the State. CARB is working in partnership with three air districts (Bay Area, San Joaquin Valley, and South Coast) and CAPCOA to implement this program. The three districts run grant programs to build clean air centers in areas under their jurisdiction and CAPCOA's program covers all other areas. Facilities must meet requirements for smoke burden, public access, and proximity to vulnerable communities. The grant program will support upgrading air filtration systems in facilities that are accessible to vulnerable populations during wildfire and other smoke events. It also supports the purchase of portable air cleaners so that clean air centers can be deployed quickly in any area of the State. U.S. EPA is also funding the Bay Area through the American Rescue Plan to implement air filtration improvements in a network of facilities in the region.²¹
- **Distributing portable air cleaners to vulnerable populations:** Some air districts conduct programs that distribute portable air filtration units and replacement air filters to help low-income individuals who do not have adequate air filtration at home and those with existing health conditions such as asthma. They often work with community organizations to operate such programs. An example of one such program is a recent distribution event held by the Santa Barbara County APCD.²²

²⁰ CARB, Wildfire Smoke Clean Air Center Grant, <https://ww2.arb.ca.gov/our-work/programs/wildfire-smoke-clean-air-center-grant>

²¹ U.S. EPA, Schools as Community Cleaner Air and Cooling Centers, <https://www.epa.gov/arp/schools-community-cleaner-air-and-cooling-centers>

²² Santa Barbara County APCD. September 27, 2021. APCD Gives Hundreds of Free Air Purifiers to Guadalupe, Casmalia Residents. <https://www.ourair.org/092721-news/>

Air Districts Significantly Impacted by Wildfire Smoke

Estimation of Wildfire Smoke Burden in Air Districts

An important component of AB 661 is the identification of air districts that are expected to be “regularly and significantly impacted by wildfire smoke.” CARB has estimated wildfire smoke exposures in California over the last ten years, from 2011 to 2021, using two metrics. The “smoke days” metric indicates how many days of high wildfire smoke a district experiences. The “person-smoke days” metric considers the size of population that is exposed to wildfire smoke. These metrics are used to quantitatively compare the relative wildfire burden between air districts as well used to categorize districts as having a *low*, *medium*, or *high* smoke burden.

Wildfire smoke exposure is estimated using data collected by a tool developed by CDPH, which used satellite data from a smoke map layer generated by National Oceanic and Atmospheric Administration (NOAA). This layer is then paired with census block population data. The dataset includes three levels of smoke intensities: *Light* indicates additional PM_{2.5} concentrations of 0-10 µg/m³ from smoke incidences; *Medium* 11-21 µg/m³; and *Heavy* 22 µg/m³ or higher. A more complete discussion of the method and data of this analysis can be found in Appendix B.

Estimation of Wildfire Smoke Burden by Number of Smoke Days

Figure 9 shows the number of wildfire smoke days from 2011 through 2021 for the three different categories of wildfire smoke exposure. It is immediately apparent how severe wildfire smoke was in 2020 and 2021 compared to previous years. The average number of “Light” intensity smoke days experienced by the California population increased from four days in 2011 to 68 days in 2021.

The map in Figure 10 shows the number of wildfire smoke days in the 35 air districts in California. For this analysis, the Northern California air districts, particularly Colusa County APCD, experienced the highest smoke burden. The corresponding wildfire smoke days are listed in Table 1. The wildfire smoke day estimates of all the districts are presented in Table B-1.

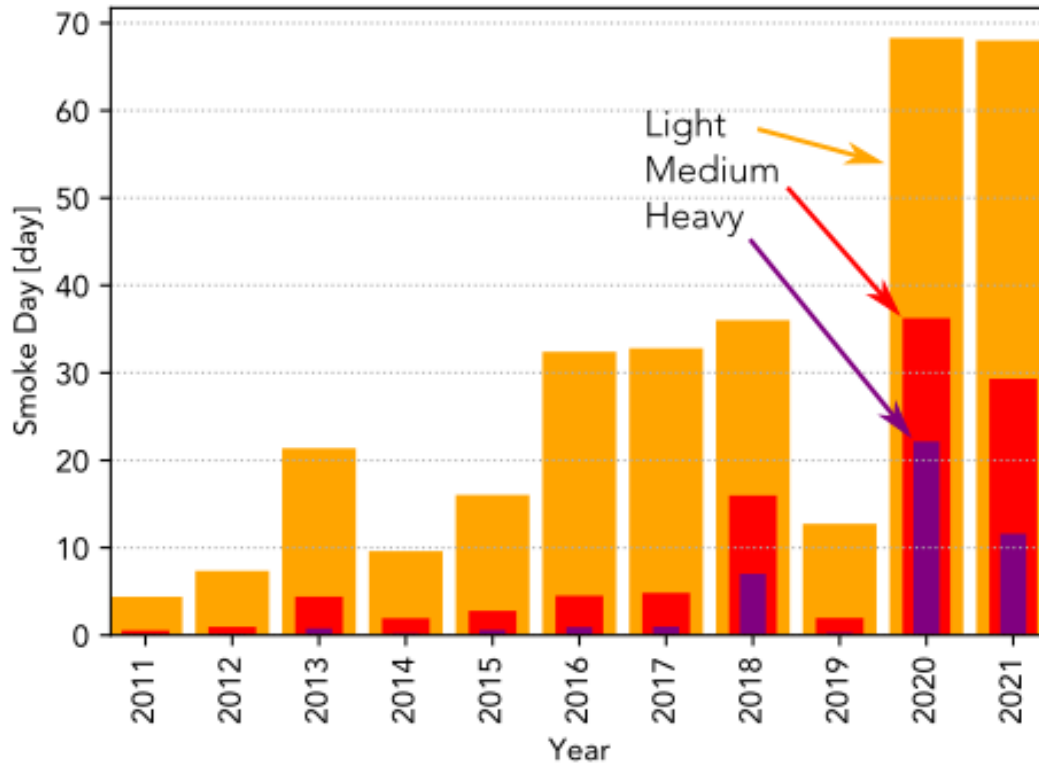


Figure 9. Estimated wildfire smoke burden by the number of wildfire smoke days in California for *Light* (0-10 $\mu\text{g}/\text{m}^3$), *Medium* (11-21 $\mu\text{g}/\text{m}^3$), and *Heavy* ($22+ \mu\text{g}/\text{m}^3$) wildfire smoke over the past 10 years from 2011 to 2021. Smoke days were calculated by averaging smoke days weighted by population at the census block group level.

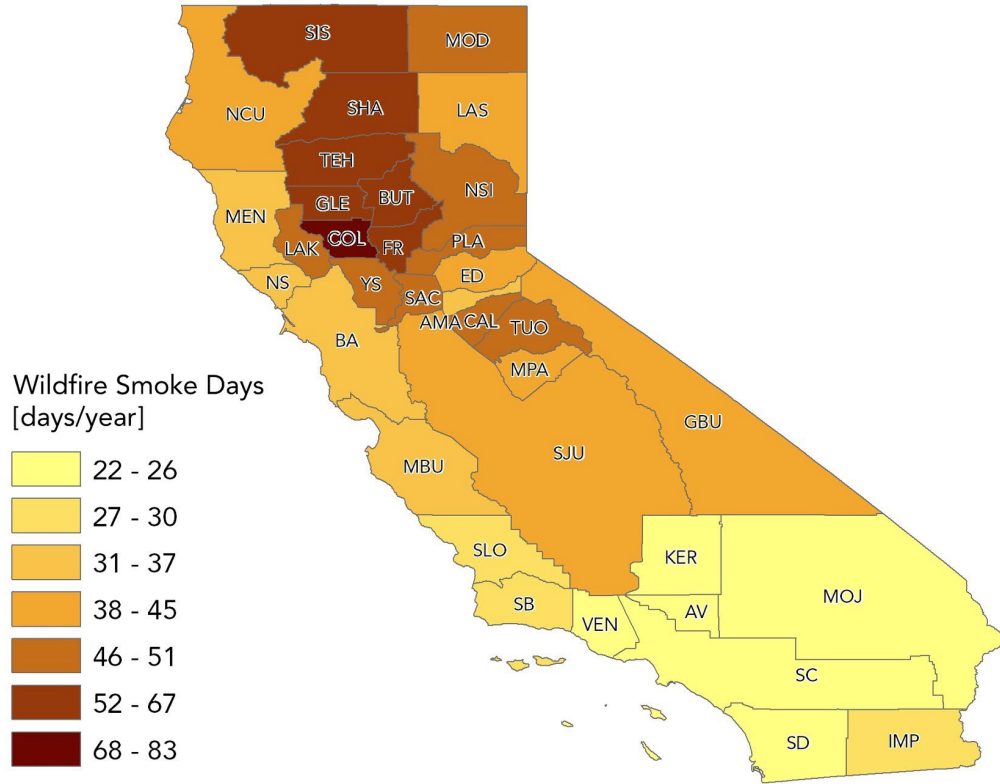


Figure 10. The number of wildfire smoke days by air district for the period 2011-2021. This analysis reveals that the northern region of the State has the highest exposure days over the past decade. See Table D-1 for the definitions of the air district abbreviations used on the map.

Table 1. Top 10 air districts with the most smoke days from 2011 to 2021. Wildfire smoke days were calculated by averaging smoke days at the census block group level weighted by population in each census block group.

Rank	Air District	Smoke days [days/year]
1	Colusa County APCD	83
2	Glenn County APCD	67
3	Siskiyou County APCD	60
4	Butte County AQMD	58
5	Tehama County APCD	57
6	Feather River AQMD	55
7	Shasta County AQMD	55
8	Placer County APCD	51
9	Tuolumne County APCD	51
10	Northern Sierra AQMD	49
	State Average	31

Estimation of Wildfire Smoke Burden by Person-Smoke Days

Figure 11 shows the other metric of person-smoke days, which accounts for the number of people in the state who are under the smoke plumes each year for the period of 2011 to 2021. The wildfire smoke exposure burden in the analysis is expressed as billions of person-days per year.

In Figure 12, the wildfire smoke burden for each air district was estimated by multiplying the size of population by the number of smoke days at the census block group level in each of the districts. The person-day metric revealed that the South Coast AQMD, which is the most populous district in the State, experienced the highest smoke burden when the size of population is considered, 390 million person-days per year, followed by the Bay Area AQMD and the San Joaquin Valley APCD (250 million and 160 million person-days per year respectively). The corresponding wildfire smoke exposure in person-days for the figure is listed in Table 2. The smoke burden estimates of all the districts are presented in Table B-2.

Although these analyses are not intended to be a predictor of future smoke exposures due to the highly variable nature of wildfire occurrence and smoke dispersion, they do provide a historical perspective of areas in which the State has experienced a high wildfire smoke burden.

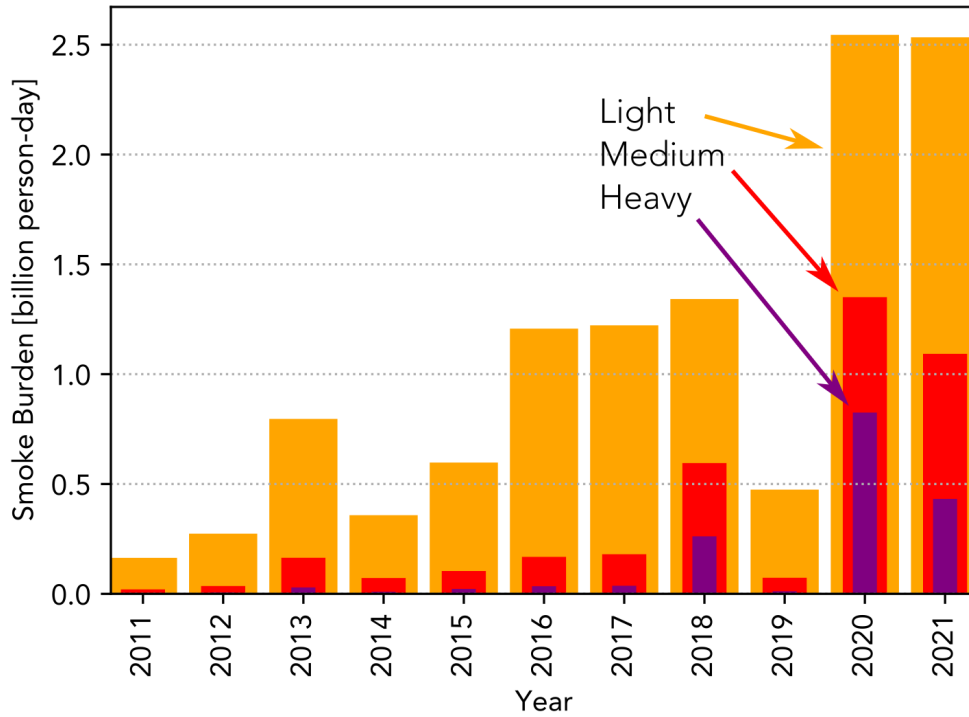


Figure 11. Estimated wildfire smoke burden by person-days in California for *Light* (0-10 $\mu\text{g}/\text{m}^3$), *Medium* (11-21 $\mu\text{g}/\text{m}^3$), and *Heavy* (22+ $\mu\text{g}/\text{m}^3$) wildfire smoke over the past 10 years from 2011 to 2021. Person-days for each year were calculated by multiplying the size of population by the number of smoke days at the census block group level over the entire State.

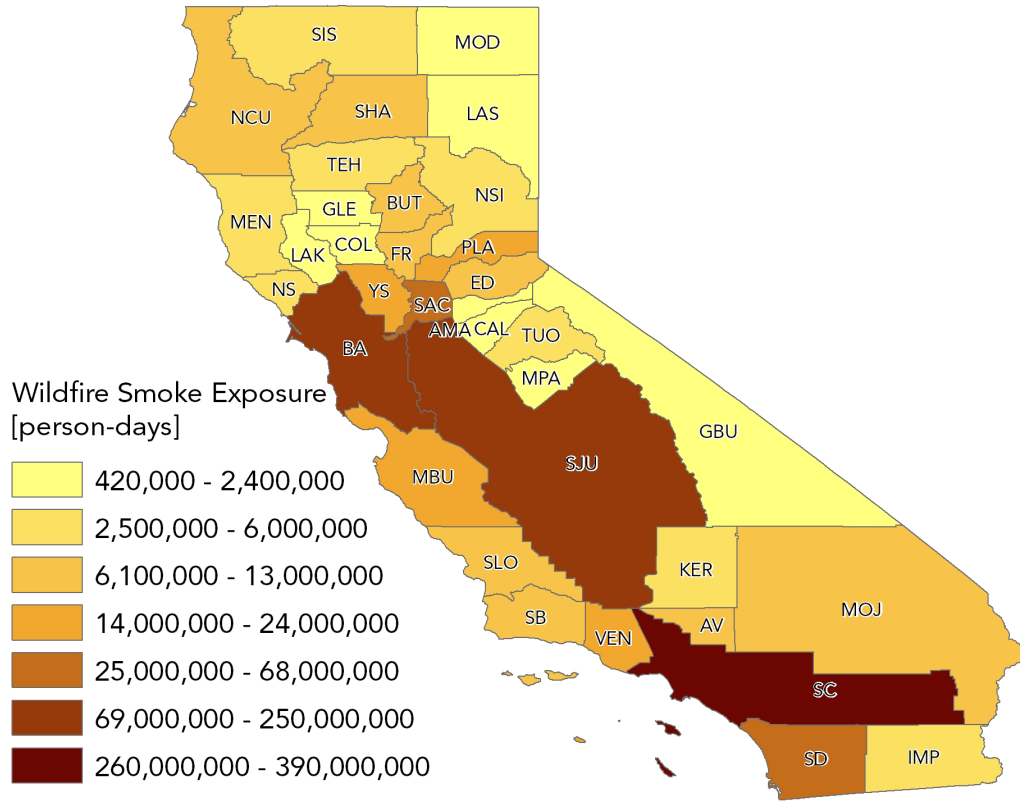


Figure 12. Annual wildfire smoke burden by person-days from 2011 to 2021. In each district, wildfire smoke burden values were calculated by multiplying the size of population by the number of smoke days at the census block group level. See Table D-1 for the definitions of the air district abbreviations used on the map.

Table 2. Top 10 air districts with the largest annual wildfire smoke burden by person-days from 2011 to 2021

Rank	Air District	Person-Days [person-days/year]
1	South Coast AQMD	390,000,000
2	Bay Area AQMD	250,000,000
3	San Joaquin Valley APCD	160,000,000
4	San Diego County APCD	68,000,000
5	Sacramento Metropolitan AQMD	66,000,000
6	Monterey Bay Air Resources District	24,000,000
7	Ventura County APCD	23,000,000
8	Placer County APCD	18,000,000
9	Yolo/Solano AQMD	17,000,000
10	Mojave Desert AQMD	13,000,000
State Total		1,200,000,000

Categorization of Air District by Wildfire Smoke Burden

AB 661 directs CARB to provide an “identification of districts that are expected to be regularly and significantly impacted by wildfire smoke.” In the previous sections, each air district’s smoke burden is determined through the calculation in terms of smoke days [days/year] and smoke exposure [person-days/year]. The former metric informs the number of wildfire smoke days experienced in each district while the latter additionally considers the size of population exposed to wildfire smoke. Based on the criteria, the districts are classified into high, medium, and low smoke burden areas. When the two metric values of an air district are different, the higher level is used for smoke burden categorization. Note that these categories of *Light*, *Medium*, and *Heavy* smoke burden are not based on specific health criteria, but they do provide a helpful metric to compare the amount of time people spend breathing in harmful smoke in different regions. As more tools and data become available in the future, CARB will be able to develop more analyses on health impacts of wildfire smoke in different regions of the State.

Figure 13 shows the criteria for the cut points. Based on the values of the two metrics of all the air districts calculated over the 10-year period, from 2011 to 2021, the criteria for high, medium, and low smoke burden areas were determined using the first quartile and the third quartile of each metric as cut points, which are 32 days/year and 51 days/year for smoke days and 2.2 million person-days/year and 14 million person-days/year for smoke exposure.

According to this categorization, 17 air districts are classified as high smoke burden areas and the remaining 18 as medium smoke burden areas. Figure 14 shows the smoke burden of the air districts classified using the criteria. Please note that no air district is evaluated as a low smoke burden area in this classification, indicating that all the districts are affected by wildfire smoke at an unhealthy level in California.

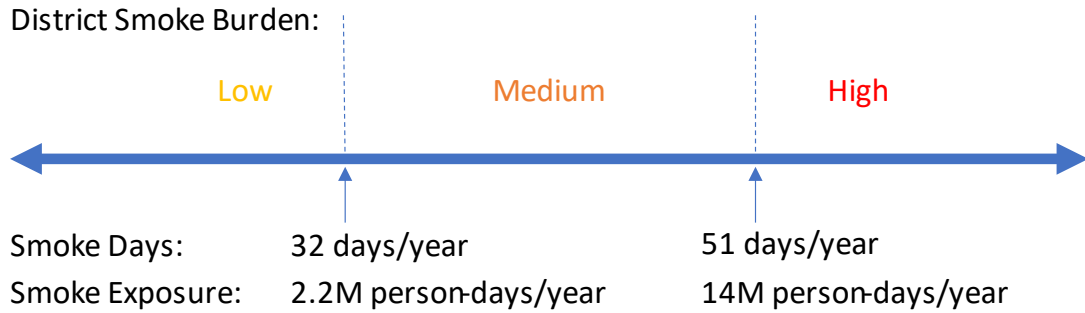


Figure 13. District wildfire smoke burden criteria based on the first- and third-quartile values of smoke days and smoke exposure estimated over the period from 2011 to 2021. When the two metric values of an air district are different, the higher level is used for smoke burden categorization. As an example, an air district that has 35 smoke days a year and a smoke exposure of 1.1M person-days/year would be categorized as “Medium.”

Table 3. Wildfire smoke burden of air districts. The air districts are classified using the criteria shown in Figure 13.

Wildfire Smoke Burden	Air Districts	
High	Bay Area AQMD Butte County AQMD Colusa County APCD Feather River AQMD Glenn County APCD Monterey Bay Air Resources District Placer County APCD Sacramento Metropolitan AQMD San Diego County APCD	San Joaquin Valley APCD Shasta County AQMD Siskiyou County APCD South Coast AQMD Tehama County APCD Tuolumne County APCD Ventura County APCD Yolo/Solano AQMD
Medium	Amador County APCD Antelope Valley AQMD Calaveras County APCD El Dorado County APCD Great Basin Unified APCD Imperial County APCD Kern County APCD Lake County AQMD Lassen County APCD	Mariposa County APCD Mendocino County AQMD Modoc County APCD Mojave Desert AQMD North Coast Unified AQMD Northern Sierra AQMD Northern Sonoma County APCD San Luis Obispo County APCD Santa Barbara County APCD
Low	None	

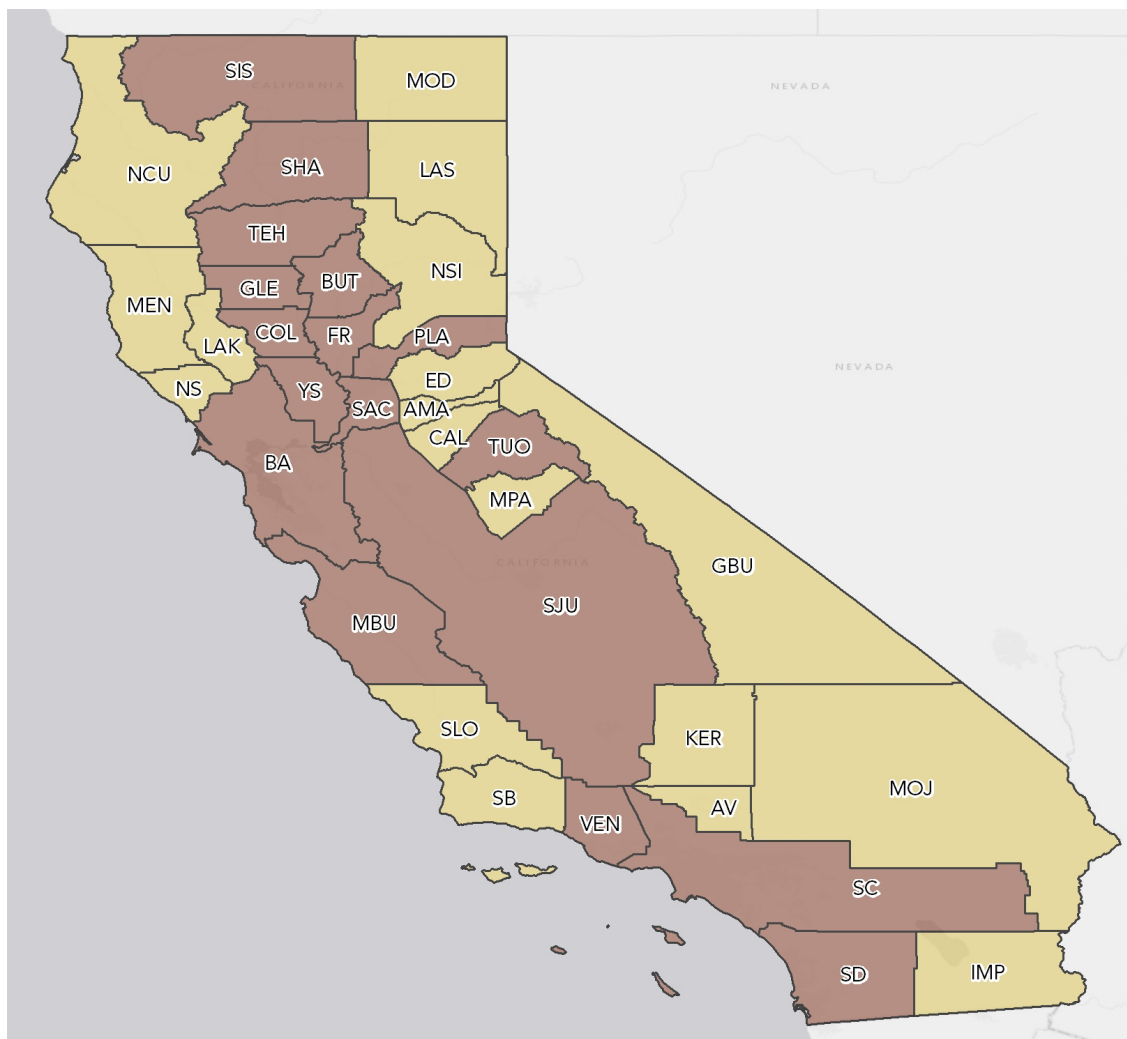


Figure 14. Wildfire smoke burden of air districts. The darker brown color indicates “High” smoke burden areas and the lighter color “Medium” smoke burden areas, which are classified using the criteria shown in Figure 13. No area was classified as “Low.” See Table D-1 for the definitions of the air district abbreviations used on the map.

Recommended Best Practices

This section provides a list of recommended air pollution-related practices and programs for wildfire smoke preparedness, based on a review of existing air district efforts. As air districts are diverse in geography, air quality, and socioeconomic considerations, it is not possible to suggest a single set of best practices that fit all the districts. It should be noted that many air districts have successfully implemented a variety of best practices over the years. However, air districts can adopt additional elements from these recommendations that fit their needs and budget. The best practices are presented in five categories: Wildfire Smoke Readiness; Wildfire Smoke and Air Quality Monitoring Information; Public Outreach for Community Health Protection; Access to Cleaner Air Spaces; and Interagency Collaboration. The best practices are summarized in Table 4.

Wildfire Smoke Readiness

Wildfire smoke readiness is key to a timely and effective response. Air districts can prepare themselves for wildfires before fire season starts each year. Working with important stakeholders in advance, air districts can help their communities be prepared to make informed decisions during wildfire smoke incidents. Key actions for successful readiness may include:

- Establishing or reconvening air district workgroups consisting of local wildfire smoke incident response and air quality monitoring staff along with staff from the local public health and local public information offices to identify best practices tailored to local conditions and plan for outreach to the public during smoke events.
- Establishing and strengthening partnerships with important stakeholders. Seamless collaborations among federal, State, local, and tribal agencies are crucial in wildfire smoke response. Air districts could identify resources accessible through such collaborations and establish working relationships with the partners.
- Establishing ongoing regular conversations with county office of education and school districts. Annually before the beginning of fire season, districts could communicate or meet with school districts to keep them up to date about wildfire-related information, available tools, and guidelines. Districts could meet with school superintendents or high-level management on wildfire smoke action plans for schools such as when to limit outdoor activities or how to decide on school closures.
- Working with community organizations and local health care providers to help them learn about the health effects of wildfire smoke and how to protect vulnerable populations from wildfire smoke exposure.
- Developing informational outreach materials and offering regular public workshops to enhance public awareness on how to respond to wildfire smoke emergencies. The workshops could educate the public about best practices before, during, and after wildfire smoke events, which are tailored to local conditions. The public would be

able to learn how to use the latest tools to get the information needed for their decision-making.

Wildfire and Air Quality Monitoring Information

Ensuring that accurate air quality information is readily available to the public is crucial in responding to wildfire smoke. To achieve this objective, some of the key actions that can be taken include:

- Enhancing monitoring capacity: Ensuring air districts have a network of air quality monitoring stations that can provide coverage without blind areas. Installing additional low-cost sensors can be an economical way to complement the coverage of an existing monitoring network.
- Expediting siting of new smoke monitoring stations: Even for air districts that have a budget to purchase air pollution sensors, there can be significant delays in installing them at appropriate locations due to siting approval processes, private property restrictions, or jurisdictional issues. Air districts could coordinate with local agencies such as cities, counties, school districts, etc. to address these obstacles, enabling them to build and operate a more extensive network of low-cost sensors.
- For large districts:
 - Providing air quality information from advanced monitoring and modeling customized for the district through the district website and mobile application.
 - Obtaining additional monitoring assistance and equipment from CARB when needed.
- For medium/small districts:
 - Obtaining additional monitoring assistance and equipment from CARB when needed.
 - Using CARB's Equipment Storage Caches to access and deploy monitoring equipment during large-scale smoke events.
 - Training district staff in the use of portable air monitoring equipment.
 - Participating in the 1300/1400 Interagency Smoke Calls organized by CARB's Modeling and Meteorology Branch to get access to the latest monitoring and modeling information.
 - Working with ARAs when they are dispatched in district areas as they have access to advanced monitoring and modeling.

Public Outreach for Community Health Protection

Successful wildfire responses depend on effective public outreach. Air districts can be prepared with a set of public outreach plans to communicate with diverse populations during emergency wildfire smoke events. Elements of successful communication plans may include:

- Educating the public on U.S. EPA’s AirNow website and Fire and Smoke Map: As AirNow has continued to advance, it has become the most important place to communicate air quality information. All the districts can promote AirNow as one of the key tools for the public to access important air quality information.
- Conducting public outreach through a comprehensive set of channels for the districts such as district websites, social network services, mailing lists, newspapers, radio channels, and television channels.
- Preparing multilingual resources. In addition to English, districts prepare outreach resources in other languages that are spoken in their jurisdiction.
- Conducting targeted outreach to avoid missing populations not covered by common channels. Oftentimes, populations that are difficult to reach are also vulnerable populations that need the most protection. Districts can work with health care providers and community organizations to reach out to those with existing health conditions and under-resourced socio-economic backgrounds.
- Working with other agencies, such as the fire department, to distribute information on community bulletin boards in areas with remote communities with limited internet or cellular connectivity.

Access to Cleaner Air Spaces

Cleaner air spaces can reduce people’s exposure to wildfire smoke substantially. Air districts can collaborate with local health departments and clean air center operators to ensure public access during smoke events. Air districts can also promote and guide people to create a cleaner air space in their homes. Activities to successfully promote cleaner air spaces can include:

- Working with city or county government offices to identify facilities that can serve as clean air centers or emergency evacuation centers each year before fire season starts. Districts should also help them prepare with better air filtration in their HVAC systems or with portable air cleaners.
- Keeping an up-to-date and precise list and map of clean air centers across the State. This information should be easily accessible to the public through a website that offers real-time updates, as well as basic details such as capacity and hours of operation. As the operation of clean air centers requires some administration and

prolonged use of the center could create financial stress on the operator, districts need to look for financial support for operators.

- Promoting the importance of creating a cleaner air space at home so that individual households can be prepared.
- Keeping a pool of portable air cleaners to be deployed to temporary clean air centers.
- Distributing or loaning portable air cleaners to vulnerable populations. Such programs could include an educational component that would help them understand the potential health risks of exposure to smoke and how to create a clean air space properly to protect indoor air quality during smoke events.

Interagency Collaboration

Close collaboration with relevant local, State, and federal agencies increases the effectiveness and reach of air district responses to wildfire smoke events. Air districts can establish or enhance existing working relationships with health departments, neighboring air districts, land management agencies, and other agencies and organizations before a wildfire smoke event begins. Air districts not only can have access to tools and information from other agencies but also can provide local expertise and information. Broader collaboration would also make it possible to inform the public of smoke and health risks with consistent messaging. Ways to continue and improve such collaboration can include:

- Participating in the 1300/1400 Interagency Smoke Calls organized by CARB's Modeling and Meteorology Branch. Air districts can get daily updates on wildfires in the State and coordinate consistent messaging with participating federal, State, local, and tribal agencies and organizations.
- Working with county health departments to coordinate public health and air quality messaging with recommended health-protective actions.
- Establishing an information clearinghouse dedicated to wildfire-related programs to help navigate through all the available programs related to wildfires. There are diverse programs related to wildfires that are operated by different State and local government agencies. As wildfire smoke issues are likely to get worse in the future, there could be more grants and other support programs. A central online location that provides all the relevant information would help support vulnerable populations during wildfire smoke events.

Table 4. Summary of Recommended Best Practices for Wildfire Smoke Emergencies for Local Air Districts

Best Practice	Description
Wildfire Smoke Readiness	<p>Prior to wildfire season, prepare public outreach and engagement plans for smoke events and deploy smoke monitoring equipment for updated air quality information. Establish or reconvene a workgroup consisting of staff from air quality and other key agencies, including emergency response, monitoring, health, and public information staff.</p> <ul style="list-style-type: none"> • Review and enhance partnerships with federal, State, and local agencies • Review and enhance ongoing regular conversations with school districts and county offices of education • Work with community organizations and local healthcare providers • Review and update information dissemination channels
Wildfire and Air Quality Monitoring Information	<p>Assess and update existing resources and tools for collecting and compiling timely wildfire air quality monitoring information to the public. Develop a work plan for improving access to this information.</p> <ul style="list-style-type: none"> • Enhance monitoring capacity to cover the entire district through additional sensors and a wider range of locations • Focus monitoring on PM_{2.5} concentrations from wildfire smoke • Train staff in the use and operation of CARB’s portable air monitors and sensors
Public Outreach for Community Health Protection	<p>Provide the public and vulnerable populations with information on how to protect themselves from wildfire smoke emergencies.</p> <ul style="list-style-type: none"> • Educate the general public on U.S. EPA’s AirNow Fire and Smoke Map and CARB’s California Smoke Spotter app

- Partner with community organizations and local health departments and clinics
- Conduct public outreach through diverse channels
- Prepare multilingual resources
- Conduct targeted outreach to avoid missing populations uncovered by common channels
- Consider a centralized website or clearinghouse for wildfire smoke information, including the up-to-date list of Clean Air Centers

Create cleaner air spaces by informing the public how to create a clean air space at home, establishing community clean air centers, and distributing portable air cleaners to vulnerable populations.

Access to Cleaner Air Spaces

- Identify facilities that can serve as clean air centers or emergency evacuation centers in coordination with local agencies
- Promote the importance of creating a clean air space at home
- Keep a pool of portable air cleaners to be deployed to temporary clean air centers
- Distribute or loan portable air cleaners to vulnerable populations
- Work with local and State agencies as appropriate

During wildfire season, communicate and coordinate regularly with federal State and local agencies

Interagency Collaboration

- Participate in ongoing coordination efforts, including the 1300/1400 Interagency Smoke Calls organized by CARB's Modeling and Meteorology Branch
- Work with county health departments to coordinate public health messaging and recommend health-protective actions

Recommendations for Additional State Funding

This report identifies important areas where the State may consider further investments to improve responses to increasing wildfire smoke emergencies in California and assist with the best practices. Funding is needed for all best practice areas listed in Table 4 to assist State and local stakeholders. Additional investments could assist all levels of government in wildfire smoke response efforts including State agencies, local air districts, local emergency response agencies, local health departments, and other agencies. Agencies such as CARB, OES, CDPH, CalFIRE, and others are well-suited for the development of statewide outreach and response programs that can improve coordination between State and local agencies and enhance public information resources. Coordinated outreach programs can benefit the public by having consistency in messaging regardless of the level of government and benefit air districts by having a framework for coordination with other agencies. Air districts have different needs and capacities depending on their size, geography, demographics, vulnerable populations, smoke impacts, and other factors. Despite these differences, additional funding can help promote stronger emergency response programs in each area of the State. In all cases, State and local agency efforts to improve information, outreach, and resources to vulnerable and highly impacted communities is a primary consideration. Some general funding priorities are identified below to assist with best practices.

Sustained and Increased Funding for Wildfire Programs

A sustainable revenue source is needed to cover the costs of wildfire smoke tasks at both the State and local levels, for both wildfire event preparedness and prescribed fire programs. For example, many local air districts do not have a sufficient revenue stream to cover the costs of their day-to-day wildfire smoke-related operations such as air quality monitoring/forecasting, collaboration with local, State, and federal government agencies, and public outreach. Districts can also use additional funding to protect public health from wildfires by ensuring that prescribed burns are conducted to minimize wildfire events. Currently, many small and rural air districts divert a substantial part of their budget, which is based primarily on permit fees, into wildfire smoke responses. It should be noted that the need to prepare in advance for wildfire smoke impacts imposes a workload on air districts even in years when they are not impacted by wildfire events. At the State level, additional funding could help significantly expand emergency preparedness and response, including the ability to provide resources to the public in multiple languages and assistance to local air districts.

Expanding Air Quality Monitoring Networks

Assistance for siting and installing low-cost air quality sensors would help boost the availability of more accurate air quality information in those areas that do not have regulatory monitors nearby and enhance smoke information available to the public. There are a variety of low-cost air quality sensors available commercially and their performance is considered reliable especially if they are calibrated to high-precision regulatory monitors.

Their role in providing air quality information during wildfire smoke events has grown substantially in recent years. In addition to funding for affordable sensors, providing assistance to local air districts with the siting processes would help promote rapid equipment deployment and broaden the air quality network during smoke emergencies.

Expanding Public Outreach

State and local information and outreach campaigns to promote more consistent and effective communication among government entities and with the public during wildfire smoke events could benefit from additional resources. Quick, precise, and accessible communication is one of the key elements of successful wildfire smoke emergency responses. Such effective communication is not easy during wildfire emergencies as these events can spread pollution over large regions, often encompassing a substantial part of the State and multiple jurisdictions. Wildfires present communication challenges for diverse stakeholders that can include State and local agencies such as local air districts, county officials, public health officials, school districts, and fire departments. Emergency preparedness requires the development and coordination of communication campaigns for wildfire smoke, web portals for information dissemination, and other related efforts. Some stakeholders have promoted the idea of developing a statewide interagency media campaign in collaboration with relevant agencies, including CalFIRE, CalEPA, CARB, CDPH, and OEHHA, to boost effective wildfire smoke incident responses. A statewide campaign could support and supplement local agencies and air districts with existing media campaigns as well as provide materials for smaller districts that do not have such a program in place.

Additional resources could also supplement efforts to conduct outreach to vulnerable populations, including those who are vulnerable due to health conditions and those living in impacted communities. Impacted communities might not be well connected to usual communication channels such as radio, television, or internet-based media, and there may also be language barriers. Targeted outreach could boost communication with these groups. Possible communication tools could include Short Message Service system, Spanish and other non-English radio channels, and outreach to healthcare facilities and assisted living facilities so that vulnerable populations, including those with existing health conditions, are not left out.

Providing Access to Cleaner Air Spaces and Portable Air Cleaners

Assisting communities in setting up and accessing cleaner air spaces is an important way to assist vulnerable communities during wildfire emergencies. Additional resources could support expansion of Clean Air Centers, which were sponsored by CARB and local air districts through programs such as AB 836 and could also assist with staffing and operation of the centers. Funds could also be used to provide transportation for the public to and from clean air centers during wildfire smoke events.

In addition to supporting clean air center operations, funds could be used to help air districts provide or loan out portable air cleaners to vulnerable populations, especially in rural areas. It would also be beneficial to consider providing additional funding for air districts, local health departments, or clinics and partners to ensure the successful implementation and operation of these programs.

Residents may not always be able to drive long distances to central clean air centers to find respite from smoke events. Portable air cleaner distribution programs could also allow a vulnerable population to shelter in place with proper protection if these devices are provided or loaned to them before or during smoke events. Such programs could include an educational component that would help people understand the potential health risks of exposure to smoke and how to create a clean air space properly to protect indoor air quality during smoke events. These programs have already been implemented in several air districts including the Bay Area AQMD, the Santa Barbara APCD, and others.

Additional funds can be used to provide staff or grants for the successful implementation and expansion of these programs, improve any logistics needed for program coordination, and develop an information clearinghouse dedicated to wildfire-related programs to help navigate through all the available State and local programs related to wildfires.

Conclusions

In response to the increasing public health threat in recent years from wildfire smoke exposures in California, CARB was tasked with identifying best practices from wildfire smoke emergency response programs in the State and identifying areas that would benefit from additional State funding. Based on this charge, CARB staff focused on collecting information from partner agencies and the State's air districts on their wildfire smoke response practices, identifying common and novel practices from these agencies, and current interactions between federal, State, and local agencies. CARB found a robust set of programs and practices in place at State agencies and local air districts, but additional work and funding support is needed to expand these practices. This report provides a list of recommended best practices for wildfire smoke events that focus on how agencies can continue to improve their wildfire smoke readiness, provide resources for wildfire smoke and air quality information, determine the best methods for disseminating information during wildfire smoke events, providing clean air spaces to the public, and continuing coordination and cooperation among federal, State, and local agencies. The report also documents the critical importance of protecting vulnerable populations and provides considerations for air districts on how to reach out and improve protection for vulnerable populations.

Appendix A. Acronyms

AB	Assembly Bill
APCD	Air Pollution Control District
AQI	Air Quality Index
AQMD	Air Quality Management District
ARA	Air Resources Advisor
Cal EPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Governor's Office of Emergency Services
Cal/OSHA	California Division of Occupational Safety and Health
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CARPA	California Air Response Planning Alliance
CDC	United States Centers for Disease Control and Prevention
CDPH	California Department of Public Health
EBAM	Environmental Beta Attenuation Monitor
FDA	Food and Drug Administration
HMS	Hazard Mapping System
IWFAQRP	Interagency Wildland Fire Air Quality Response Program
NOAA	National Oceanic and Atmospheric Administration
OEHHA	Office of Environmental Health Hazard Assessment
PM _{2.5}	Fine Particulate Matter
U.S. EPA	United States Environmental Protection Agency
USFS	United States Forest Service

Appendix B. The Method for Estimating Smoke Burden

The smoke burdens reported in this report were analyzed using the data from 2011 to 2021 collected by a tool developed by the California Department of Public Health.²³ The tool takes data from the National Oceanic and Atmospheric Administration’s (NOAA) map that is derived from the high-spatial resolution visible imagery of smoke plumes from satellites, which is known as the Hazard Mapping System (HMS) Fire and Smoke Product. The smoke plumes on the map layer get categorized as three levels of additional PM_{2.5} concentrations from wildfire smoke: Light for 0–10 µg/m³ of additional PM_{2.5}, Medium for 11–21 µg/m³, and Heavy for 22 µg/m³ or higher. The tool also matches the high-resolution smoke information with population at the census block group level. Among the three levels, the Light smoke values were used for smoke burden calculations.

The smoke burdens are quantified using two metrics, “smoke days” and “person-smoke days.” The “smoke days” metric indicates how many days of high smoke a district experiences. The “person-smoke days” metric considers the population number that is exposed. For each year, the data at the census block group level were aggregated by air district with population as weight for smoke exposure in terms of. For each air district, the two metrics were calculated by the following equations:

$$\text{Burden By Smoke Days [days]} = \sum_i^{\text{All census block groups}} \frac{\text{Population}_i \times \text{Smoke Day}_i}{\text{Population}_{\text{total}}}$$

$$\text{Burden By Person- Days [person \cdot \text{days}]} = \sum_i^{\text{All census block groups}} \text{Population}_i \times \text{Smoke Day}_i$$

where Population_{*i*} is the size of population at Census block group *i*, Smoke Day_{*i*} is the number of smoke days at Census block group *i*, and Population_{total} is the total population of the air district. The values of the two metrics of all the air districts are presented in Tables B-1 and B-2.

There are a few caveats to using satellite data versus ground-level data. The concentrations derived from HMS Smoke density may not correspond exactly to the ground concentrations. The visible imagery is affected by cloud cover, and it cannot determine plume height. Also, the smoke measurements are generated completely from satellite passes occurring during daylight hours. Despite these limitations, HMS has been validated and shown to correlate with elevated PM_{2.5} concentrations from ground-level monitors. A 2015 study has shown that

²³ Vargo, Jason A. “Time Series of Potential US Wildland Fire Smoke Exposures.” *Frontiers in Public Health* 8 (2020): 126. <https://doi.org/10.3389/fpubh.2020.00126>.

HMS Smoke plumes can reliably identify periods of wildfire influence in the Air Quality System records with 95% accuracy.²⁴

²⁴ Preisler, Haiganoush K., Donald Schweizer, Ricardo Cisneros, Trent Procter, Mark Ruminski, and Leland Tarnay. "A Statistical Model for Determining Impact of Wildland Fires on Particulate Matter (PM_{2.5}) in Central California Aided by Satellite Imagery of Smoke." *Environmental Pollution* 205 (October 1, 2015): 340-49. <https://doi.org/10.1016/j.envpol.2015.06.018>.

Table B-1. Smoke burden by the number of smoke days [days/year] of air districts in California. Values are reported with two significant digits.

Air District	Smoke Days [days/year]
Colusa County APCD	110
Great Basin Unified APCD	96
Glenn County APCD	94
Siskiyou County APCD	93
Butte County AQMD	93
Tehama County APCD	86
Northern Sierra AQMD	85
Shasta County AQMD	84
Placer County APCD	83
Feather River AQMD	81
Tuolumne County APCD	81
Lake County AQMD	81
Modoc County APCD	81
Calaveras County APCD	79
Lassen County APCD	78
El Dorado County APCD	77
Imperial County APCD	77
Sacramento Metropolitan AQMD	77
San Joaquin Valley Unified APCD	77
Yolo/Solano AQMD	74
San Diego County APCD	70
Bay Area AQMD	68
Mojave Desert AQMD	67
Antelope Valley AQMD	67
Northern Sonoma County APCD	66
Mendocino County AQMD	66
Mariposa County APCD	66
Kern County APCD	65
Ventura County APCD	64
South Coast AQMD	64
North Coast Unified AQMD	63
Monterey Bay Unified APCD	63
Santa Barbara County APCD	62
San Luis Obispo County APCD	57
Amador County APCD	57

Table B-2. Smoke burden by person-smoke days of air districts in California. *Light* indicates 0–10 µg/m³ of additional PM_{2.5} from wildfire smoke, *Medium* 11–21 µg/m³, and *Heavy* 22+ µg/m³. Values are reported with two significant digits.

Air District	Person Days [person-days/year]		
	Light	Medium	Heavy
South Coast AQMD	390,000,000	100,000,000	39,000,000
Bay Area AQMD	250,000,000	96,000,000	42,000,000
San Joaquin Valley Unified APCD	160,000,000	67,000,000	32,000,000
San Diego County APCD	68,000,000	14,000,000	5,200,000
Sacramento Metropolitan AQMD	66,000,000	26,000,000	12,000,000
Monterey Bay Unified APCD	24,000,000	10,000,000	3,900,000
Ventura County APCD	23,000,000	6,900,000	2,400,000
Placer County APCD	18,000,000	7,100,000	3,500,000
Yolo/Solano AQMD	17,000,000	6,500,000	3,100,000
Mojave Desert AQMD	13,000,000	4,400,000	1,600,000
Butte County AQMD	11,000,000	4,700,000	2,600,000
Santa Barbara County APCD	11,000,000	3,600,000	1,500,000
Feather River AQMD	9,700,000	3,300,000	1,700,000
Shasta County AQMD	9,600,000	4,600,000	2,600,000
Antelope Valley AQMD	9,300,000	3,400,000	1,200,000
San Luis Obispo County APCD	9,100,000	3,000,000	1,200,000
El Dorado County APCD	7,500,000	3,100,000	1,600,000
North Coast Unified AQMD	7,200,000	3,200,000	1,500,000
Northern Sierra AQMD	6,000,000	2,500,000	1,200,000
Imperial County APCD	4,900,000	920,000	340,000
Tehama County APCD	4,500,000	2,000,000	1,100,000
Tuolumne County APCD	3,900,000	1,700,000	750,000
Mendocino County AQMD	3,500,000	1,400,000	610,000
Kern County APCD	3,200,000	1,300,000	570,000
Siskiyou County APCD	3,100,000	1,600,000	920,000
Northern Sonoma County APCD	2,800,000	1,100,000	540,000
Lake County AQMD	2,400,000	960,000	500,000
Glenn County APCD	1,800,000	670,000	370,000
Calaveras County APCD	1,600,000	620,000	290,000
Amador County APCD	1,100,000	440,000	200,000
Lassen County APCD	1,100,000	510,000	300,000
Great Basin Unified APCD	1,000,000	490,000	250,000
Colusa County APCD	920,000	310,000	160,000
Modoc County APCD	430,000	200,000	110,000
Mariposa County APCD	420,000	190,000	97,000

Appendix C. Wildfire Smoke Response Resources

Wildfire Smoke Response Guidelines

U.S. EPA. "Wildfire Smoke a Guide for Public Health Officials Revised 2019." Research Triangle Park, NC: United States Environmental Protection Agency. Office of Air Quality Planning and Standards. Health and Environmental Impacts Division., August 2019.
<https://www.airnow.gov/sites/default/files/2021-05/wildfire-smoke-guide-revised-2019.pdf>.

CDPH. "Wildfire Smoke Considerations for California's Public Health Officials." California Department of Public Health, August 2022.
https://www.cdph.ca.gov/Programs/EPO/CDPH%20Document%20Library/EOM%20Documents/Wildfire-Smoke-Considerations-CA-PHO_08-2022.pdf.

Wildfire Smoke Response Resources Referenced in the Report

CAL FIRE:

- Ready for Wildfire: <https://www.readyforwildfire.org/>
- CAL FIRE Incident Information: <https://www.fire.ca.gov/incidents/>

California Air Resources Board

- Protecting Yourself from Wildfire Smoke: <https://ww2.arb.ca.gov/protecting-yourself-wildfire-smoke>
- California Smoke Spotter: <https://ww2.arb.ca.gov/resources/fact-sheets/California-smoke-spotter>

California Environmental Protection Agency

- Fire Response and Recovery: <https://calepa.ca.gov/disaster/fire/>

California Office of Environmental Health Hazard Assessment

- Wildfires: <https://oehha.ca.gov/public-information/general-info/wildfires>

California Smoke Information Blog: <http://californiasmokeinfo.blogspot.com/>

Center for Disease Control and Prevention

- Protect Yourself from Wildfire Smoke: <https://www.cdc.gov/nceh/features/wildfires/>
- Wildfire Smoke and COVID-19: https://www.cdc.gov/disasters/covid-19/wildfire_smoke_covid-19.html

Interagency Wildland Fire Air Quality Response Program:
<https://www.wildlandfiresmoke.us/>

National Wildfire Coordinating Group

- Fire Incident Information System (InciWeb): <https://inciweb.nwccg.gov/>

U.S. Environmental Protection Agency

- Wildfires: <https://www.epa.gov/natural-disasters/wildfires>
- AirNow: <https://www.airnow.gov/>
- Fire and Smoke Map: <https://fire.airnow.gov/>
- Smoke-Ready Toolbox for Wildfires: <https://www.epa.gov/smoke-ready-toolbox-wildfires>
- Protect Your Lungs from Wildfire Smoke or Ash:
<https://www.airnow.gov/sites/default/files/2021-12/protect-your-lungs-from-wildfire-smoke-or-ash.pdf>

U.S. Forest Service

- AirFire Tools: <https://portal.airfire.org/>
- Blue Sky: <https://tools.airfire.org/playground/v3.5/emissionsinputs.php>

Wildfire Information Pages on Air District Websites

Wildfire and air quality information is provided by local air districts at the links below. Links to main district websites can also be found here: [California Air Districts | California Air Resources Board](#)

Amador County APCD

- Wildfire Smoke Information: <https://www.amadorgov.org/services/amador-air-district/2014-wildfire-smoke-information>

Antelope Valley AQMD

- Burn & Smoke Information: <https://avaqmd.ca.gov/burn-smoke-information>

Bay Area AQMD

- Wildfire Air Quality Response Program: <https://www.baaqmd.gov/about-air-quality/wildfire-air-quality-response-program>

Butte County AQMD

- Wildfires and Air Quality: <https://bcaqmd.org/resources-education/wildfires/>

Calaveras County APCD

- Wildfire Smoke Information: <https://ema.calaverasgov.us/Air-Pollution-Control/Wildfire-Smoke-Information>

Colusa County APCD

- Wildfire Information: <https://www.countyofcolusa.org/982/Wildfire-Information>

Eastern Kern APCD

- Smoke and Fire Information:
http://www.kernair.org/Main_Pages/Subpages/Info_Sub/Smoke_and_Fire.html

El Dorado County AQMD

- Wildfire Information:
https://www.edcgov.us/Government/AirQualityManagement/Pages/wildfire_information.aspx

Feather River AQMD

- Wildfire Smoke: <https://www.fraqmd.org/wildfire-smoke>

Glenn County APCD

- Wildfire Smoke & Other Health Effects:
<https://www.countyofglenn.net/dept/agriculture/air-pollution-control-district/wildfire-smoke-other-health-effects>

Great Basin Unified APCD

- Active Wildfire: <https://www.gbuapcd.org/AirMonitoringData/Smoke/>

Lassen County APCD

- Smoke Information: <http://www.lassenair.org/smoke-information.html>

Mendocino County AQMD

- How to Protect Yourself from Wildfire Smoke: <http://www.co.mendocino.ca.us/aqmd/wildfire-smoke-your-health.html>

Mojave Desert AQMD

- Wildfires: <https://www.mdaqmd.ca.gov/air-quality/wildfires>

Monterey Bay Air Resources District

- Wildfire Smoke Information and Resources: <https://www.mbard.org/wildfire-smoke-information-and-resources>

North Coast Unified AQMD

- Wildfire Smoke: <https://www.ncuaqmd.org/wildfire-smoke>

Northern Sonoma County APCD

- Tips for Wildfire Smoke Resiliency: <https://nosocoair.org/wp-content/uploads/2023/07/Tips-for-Wildfire-Smoke-APR2023.pdf>

Placer County APCD

- Smoke Information: <https://www.placerair.org/8126/Smoke>

Sacramento Metro AQMD

- Smoke Update: <http://www.sparetheair.com/wildfire.cfm>

San Diego APCD

- Incident Response Resources and Information: <https://www.sdapcd.org/content/sdapcd/air-quality/incident-response.html>

San Joaquin Valley APCD

- Wildfire Information: <https://ww2.valleyair.org/air-quality-information/wildfire-information/>

San Luis Obispo County APCD

- Wildfire Air Quality Impacts: <https://www.slcleanair.org/air-quality/wildfire.php>

Santa Barbara County APCD

- Protect Yourself from Wildfire Smoke: <https://www.ourair.org/smoke-health/>

Shasta County AQMD

- Wildfire Smoke Information: <https://www.shastacounty.gov/air-quality/page/wildfire-smoke-information>

Siskiyou County APCD

- Fire and Smoke Information: <https://www.co.siskiyou.ca.us/airpollution/page/fire-and-smoke-information>

South Coast AQMD

- Wildfire Smoke & Ash Health & Safety Tips: <http://www.aqmd.gov/home/air-quality/wildfire-health-info-smoke-tips>

Tehama County APCD

- News / Wildfire: <https://www.tehcoapcd.net/blog/category/wildfire/>

Ventura County APCD

- Wildfire Smoke Text/Audio Alert System for Farmworkers: <http://www.vcapcd.org/smoke/>

Yolo-Solano AQMD

- Wildfire Smoke Information: <https://www.ysaqmd.org/about-the-district/news-outreach/wildfire-smoke-information/>

Others

Cal OES

- State Recovery Resources: <https://wildfirerecovery.caloes.ca.gov/>

California Department of Insurance

- Wildfire Recovery and Readiness: <https://www.insurance.ca.gov/01-consumers/200-wrr/>

Appendix D. Air Districts in California

The State of California is divided into 35 air districts as shown in Figure D-1.²⁵ The air districts are responsible for regional air quality planning, monitoring, and stationary source and facility permitting.

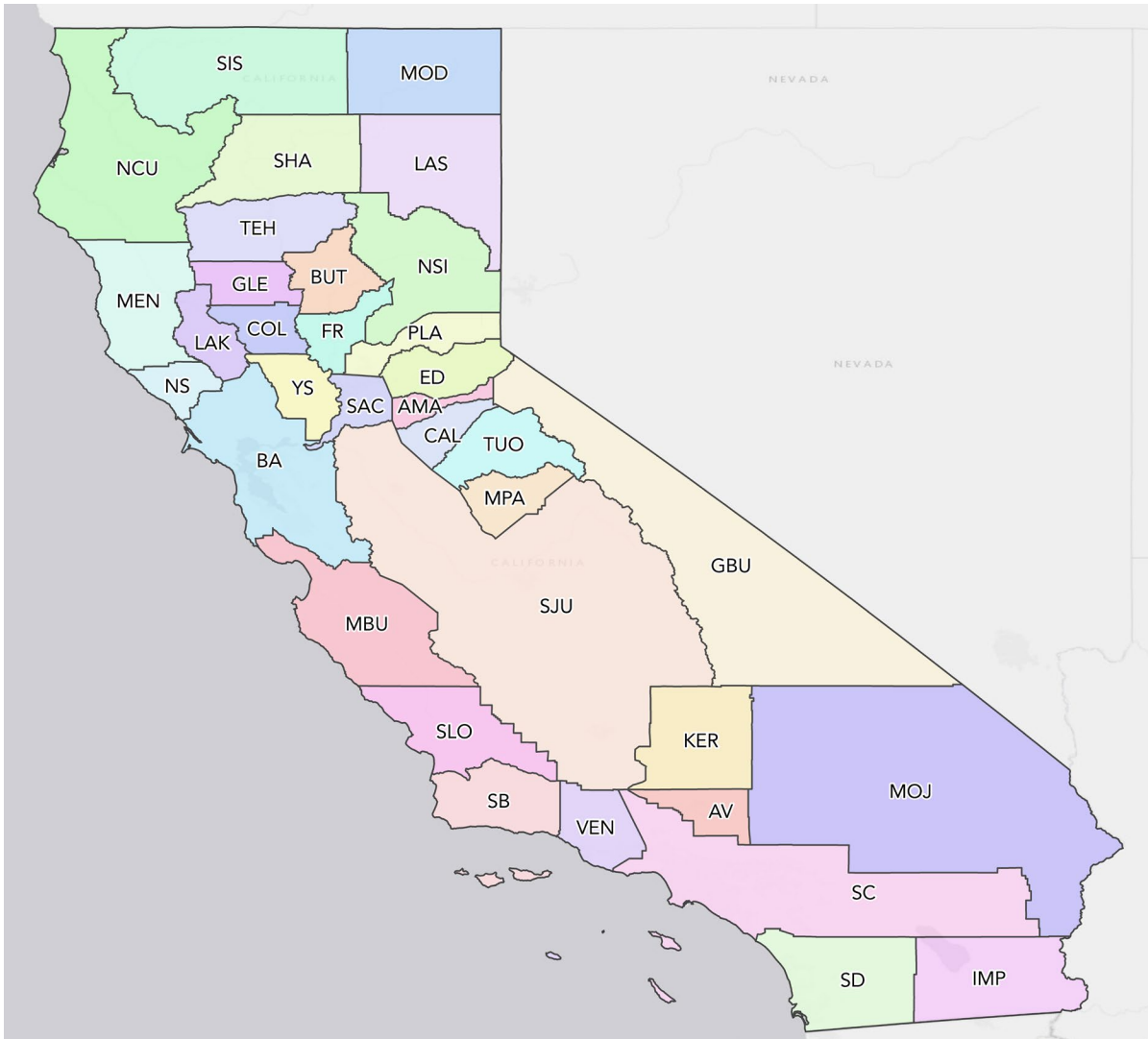


Figure D-1. California’s 35 air districts. See Table D-1 for the definition of air district abbreviations on the maps.

²⁵ Visit the following webpage for more information about all the air districts: <https://ww2.arb.ca.gov/california-air-districts>

Table D-1. Definition of air district abbreviations used in this report.

Abbreviation	Air District
AMA	Amador County APCD
AV	Antelope Valley AQMD
BA	Bay Area AQMD
BUT	Butte County AQMD
CAL	Calaveras County APCD
COL	Colusa County APCD
ED	El Dorado County APCD
FR	Feather River AQMD
GBU	Great Basin Unified APCD
GLE	Glenn County APCD
IMP	Imperial County APCD
KER	Eastern Kern County APCD
LAK	Lake County AQMD
LAS	Lassen County APCD
MBU	Monterey Bay Air Resources District
MEN	Mendocino County AQMD
MOD	Modoc County APCD
MOJ	Mojave Desert AQMD
MPA	Mariposa County APCD
NCU	North Coast Unified AQMD
NS	Northern Sonoma County APCD
NSI	Northern Sierra AQMD
PLA	Placer County APCD
SAC	Sacramento Metropolitan AQMD
SB	Santa Barbara County APCD
SC	South Coast AQMD
SD	San Diego County APCD
SHA	Shasta County AQMD
SIS	Siskiyou County APCD
SJU	San Joaquin Valley APCD
SLO	San Luis Obispo County APCD
TEH	Tehama County APCD
TUO	Tuolumne County APCD
VEN	Ventura County APCD
YS	Yolo/Solano AQMD