

Wildfires & Smoke

By September 2017, one of the worst fire seasons in U.S. history had consumed hundreds of millions of acres, from Florida and Georgia to the Pacific. California's fires have cost dozens of lives and destroyed many neighborhoods. Wildfires pose immediate danger to lives and property, but air quality affected by smoke and ash may also pose large, hidden impacts far from the flames. This factsheet draws on lessons learned by clean air agencies from recent wildfire responses. It highlights issues for those affected by wildfires to consider, and provides ideas on where to turn to for support.

Why worry about wildfires?

The journal *Science* found, in 2006, that the typical wildfire season in the U.S. had extended by about 75 days since the 1970s. Wildfire smoke is made up of a complex mixture of gases and fine particles produced when wood and other organic materials burn. Although formaldehyde, carbon monoxide, and other hazardous chemicals are a part of the problem, the biggest health threat from smoke is from fine particulates. "Particulates" is a generic term for matter suspended in the air, typically as a mixture of both solids and liquid droplets, and the most concerning are those of 10 microns (referred to as PM10) and smaller, including PM2.5 and tiny "ultrafine" particles (less than 0.1 micron in diameter). These particles are substantially finer than the width of a human hair and can penetrate deep into lungs and potentially cause chronic health problems. Exposure to PM2.5 is measured in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) over a 24-hour average. EPA has established health-based

national ambient air quality standards (NAAQS) for 24-hour and annual exposure, and since 2001 most of the U.S. has seen a steady improvement in average annual and worst-day PM2.5 concentrations. EPA set the PM2.5 24-hour standard to the current $35 \mu\text{g}/\text{m}^3$ in 2006, and the PM2.5 annual average standard to the current $12 \mu\text{g}/\text{m}^3$ in 2012.

For people with preexisting heart and lung conditions, sudden exposure to higher-than-average PM2.5 levels increases the risk of asthma attacks, coronary events, and even death. During wildfire events, when daily concentrations of PM2.5 can dramatically exceed the health-based standard, acute health risks may greatly increase for sensitive groups.

Sensitive populations include:

- People with heart or lung disease, such as heart failure, angina, ischemic heart disease, chronic obstructive pulmonary disease, emphysema, or asthma
- Older adults, who are more likely to have heart or lung disease than younger people
- Children and teenagers, who have developing lungs and breathe more air and are more likely to have asthma
- Pregnant women and their developing pregnancies are both at special risk for health effects

How bad is it?

A helpful tool for understanding and communicating about the air quality in areas affected by smoke is the Air Quality Index (AQI). The AQI is a tool that reflects the health-based NAAQS

for several pollutants, including PM2.5. The AQI uses a color-coded scale to communicate the health impacts of pollution at different concentrations, in the case of PM2.5, measured in $\mu\text{g}/\text{m}^3$ over a 24-hr average.

The AQI (at www.airnow.gov)

0-50: Good
51-100: Moderate
101-150: Unhealthy for sensitive groups
151-200: Unhealthy for everyone
201-300: Very unhealthy for everyone
>300: Hazardous for everyone

How air agencies can help

Air quality improvements in areas with pollutant levels that exceed the NAAQS can be set back by wildfires that contribute significantly to ambient air pollution. Research on the 2017 California wildfires showed they produced the same amount of PM2.5 in one week as cars in the state produced in a year.

Firefighters, emergency managers, and other decision-makers deal with the emergency conditions, but air quality officials can play three key roles in managing the immediate impacts from wildfires: take steps to support prevention, monitor the situation, model the smoke, and deploy accurate public messages.

Prevention

The most effective actions for prevention of wildfires are in the wheelhouse of public land managers,

who manage the conditions under which wildfires can start and spread. Air agencies may also play a role, issuing “no burn” requirements on days when air quality is poor, or providing input about planned burns on public lands. Although there are tradeoffs with their emissions, done thoughtfully, prescribed burns or avoided burns can provide a valuable tool for wildfire prevention.

Monitoring

The EPA’s AirNow website (<https://www.airnow.gov/>) displays air quality data by zip code for anywhere in the U.S., and is a potent tool for understanding air quality conditions as they are affected by smoke.

Smoke is monitored by a combination of fixed equipment and temporary monitors. The U.S. National Forest Service’s Wildland Fire Air Quality Response Program (<https://www.wildlandfiresmoke.net/>) has stockpiled smoke monitoring equipment that can be deployed to incidents to understand the magnitude of smoke impacts. Commonly used hardware includes E-BAM units, which are portable PM_{2.5} monitoring instruments that are deployed as needed. Smoke monitors that measure PM_{2.5} are tied into the satellite systems and provide near real-time data to the public via EPA’s AirNow website.

Widespread wildfire smoke affects communities and school districts without a nearby air quality monitoring station or AQI. In cases like this, the 5-3-1 Visibility Method helps communities use local landmarks to compare to the color-coded AQI chart. More information is summarized by New Mexico’s Fire & Health tracking system (<https://nmtracking.org/environment/air/FireAndSmoke.html> or [here](#)).

Modeling

Some state and federal agencies may use computer models to determine the extent of an affected area and predict what might happen under different and changing conditions. The Pacific Northwest Research Station’s AirFire

Team supports operational smoke forecasting and uses a modeling framework called BlueSky (<https://www.airfire.org/bluesky/>), a web-based system that generates daily plume forecasts and estimates current and future PM concentrations throughout the lower 48 states and Alaska.

Air Resource Advisors (ARAs) are technical specialists who have expertise in interpreting modeling results and making recommendations. ARAs coordinate between air quality and health agencies, can help public information officers in fire information outreach efforts, and provide information to state smoke websites. Several state air agencies and fire management agencies use ARAs, who can offer:

- Smoke information within incident management decision processes,
- Expert use of tools like BlueSky modeling and forecasting tools that can be used for improved messaging and
- Acting as liaison to local agencies and communities.

Messaging

Air agencies can play a central role in helping people protect their health by keeping them informed. Key messages to convey include:

- Avoiding exposure (outdoors, indoors or both), or even evacuating the area,
- Reducing other contributors to unhealthy air quality, and
- Taking other protective measures (e.g., this message can be accompanied by good information about particulate masks).

These recommendations can help schools decide whether to cancel a football game, or mayors decide whether to recommend to older citizens that they leave the area. Helpful measures some air agencies may take include:

- Issuing recommendations for public health actions,
- Providing public service announcements,
- Providing public advisories about protective measures, and
- Distributing smoke forecasts and impact summaries.

Where necessary, consider articulating specific messages around the protection of children and sensitive groups, possibly referring to the 5-3-1 method. In summary, this method makes more stringent recommendations for sensitive groups and the public as visibility is reduced by smoke to 5, 3, and 1 miles.

Because more than one area may be affected, it may be essential to coordinate with neighboring state and local air districts, and public health agencies. This will help to sync communications across affected areas, and across the institutional incident command systems established to deal with the fires.

Involving — or giving the lead to — other agencies like public health, fire management, or elected officials may improve the effectiveness of your public communications around wildfires. Even if you choose not to use (or don’t have access to) traditional media, posting on the Web, Twitter, and other social media is a powerful way to communicate with the public. A good example of an effective online tool used to communicate with the public is the Oregon Smoke Blog (<http://oregonsmoke.blogspot.com/>). Other state and local agencies have deployed similar sites.

NACAA has compiled a library of state and federal resources and tools at <http://www.4cleanair.org/wildfire-and-wood-smoke-resources> (also [here](#)).

CONTACT NACAA AT
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