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INSIGHT

Wildfire Smoke and Air Quality

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Air quality and associated health impacts have long been affected by a variety of factors. Some Members of Congress have expressed concern about health risks from wildfire smoke, which contains fine particles. This Insight provides background on air quality standards and trends, air quality data sources, federal air quality requirements related to wildfires, and wildfire smoke response programs.

Background

Smoke from wildfires and prescribed burning, along with emissions from power plants, automobiles, and industrial sources, contribute to fine particles (less than 2.5 microns, or "PM2.5") in ambient (outdoor) air. The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to establish minimum national standards for ambient air quality. EPA has set and periodically revised national ambient air quality standards (NAAQS) for six "criteria" air pollutants, including the principal constituent of wildfire smoke: fine particles. Under the CAA, states have primary responsibility for assuring compliance with NAAQS and establishing state implementation plans intended to meet these standards. To simplify reporting, EPA developed a color-coded "Air Quality Index" (AQI), ranging from 0-500, with an AQI of 100 corresponding to the short-term NAAQS for a specific pollutant.

Wildfire smoke is a complex mixture of gases and fine particles that temporarily degrades air quality over long distances—potentially thousands of miles—and may harm human health. The chemical composition of smoke depends on various factors, including burn conditions (e.g., fire temperature) and type of materials burned (e.g., vegetation or structures). Fine particles are the principal pollutant of concern from wildfire smoke. Additional pollutants of concern from wildfire smoke include carbon monoxide, hazardous air pollutants, and emissions that contribute to the formation of ground-level ozone.

EPA's National Emissions Inventory (NEI) identifies wildfires as a major contributor of fine particles, though quantifying the precise contribution remains an active area of research. Generally, air quality impairment from fine particles has declined by more than half during the past few decades, and ozone remains the more common air pollution concern generally. The pollutant of concern to particular communities varies greatly and depends on specific location and time considerations.

Fine particles from smoke can be inhaled deeply into the lungs, and may contribute to a range of health effects, including eye irritation, sore throat, coughing, breathing difficulties, worsening of preexisting heart and lung disease, and increased premature mortality. While smoke may affect the health of any

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individual exposed, sensitive populations—children, pregnant women, and the elderly—are more vulnerable to the exposure. Also, wildland firefighters are exposed to particles and other smoke constituents, including carcinogens. Less is known about cumulative and long-term exposure to wildfire smoke.

Air Quality Requirements and Wildfires

Air quality impacts from wildfire smoke may be measured by air monitoring stations comprising a national network. This monitoring network, in combination with modeling analyses, informs determinations about NAAQS compliance. Congress authorized EPA to treat emissions from certain natural events differently than those from anthropogenic sources. The CAA allows EPA to exclude air quality data from regulatory decisions if air quality is demonstratively influenced by "exceptional events" such as certain natural events (42 U.S.C. §7619(b)). EPA described conditions under which states and tribes can demonstrate that air quality impacts from wildfires (or prescribed fires) should be excluded from NAAQS compliance determinations.

Wildfire smoke may also affect implementation of CAA visibility requirements. The CAA established a national visibility goal and authorized a regional haze program to protect visibility in national parks and wilderness areas (42 U.S.C. §7491).

State-level regulations may also apply to wildfire smoke. Many states have developed programs to manage and control smoke from prescribed burns. Smoke management plans seek to minimize smoke entering populated areas, prevent public safety hazards, and maintain CAA compliance.

Wildfire Smoke Response

Wildfire response strategies include air quality monitoring, smoke forecasting, and timely communication of air quality conditions and related health risks to the public. Various federal, tribal, state, and local agencies contribute to these tasks.

EPA and other agencies have developed tools to measure air quality conditions and alert the public. For example, EPA manages AirNow, a multiagency website that reports air quality based on monitoring data received on a regular basis from state, local, and federal agencies.

AirNow reports air quality information using the AQI, a nationally uniform index. EPA calculates the AQI for a criteria pollutant based on the ambient concentration of that pollutant. The higher the AQI, the greater the level of air pollution. EPA describes AQI values of 100 or lower as satisfactory.

The Interagency Wildland Fire Air Quality Response Program (IWFAQRP) contributes to air quality monitoring and communication. Led by the U.S. Forest Service (USFS), this interagency program was created to address risks posed by wildland fire smoke. The program has a national cache of smoke monitoring equipment and deploys technical specialists—Air Resource Advisors (ARAs)—during large smoke events. ARAs may provide, install, and operate monitors, develop smoke forecasts, and share information with wildfire response teams, air quality regulators, and the public.

The need for real-time air quality information is critical during wildfires. The frequency of air quality reporting varies, however, depending on the equipment used. Also, permanent monitors may not be located near the areas affected by smoke. While temporary monitors may be deployed, specialists also use computer modeling to estimate pollution levels.

EPA, USFS, other agencies, and stakeholders are exploring emerging technologies to improve air quality monitoring during wildfire events. For example, the AirNow Sensor Data Pilot adds air pollution data from "low-cost sensors" to the Fire and Smoke Map, which also uses satellite imagery to track smoke.

Federal agencies caution that such data should be considered supplemental to existing resources, given uncertainties about the sensor data.

As Congress deliberates on wildfire legislation, it may consider options for monitoring strategies to help inform smoke management and public health responses. Monitoring strategies may include some combination of stationary monitors, mobile sensors, or models. Congress may also consider monitoring costs, which may vary by location, along with public health benefits.

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