The EPA's Guidance for Improving Indoor Air Quality During Wildfire Smoke Events

to Reduce Health Impacts from Smoke

Focusing on Recommendations Relevant to Schools

Introduction

In May 2025, the U.S. Environmental Protection Agency (EPA) published a ***Best Practices Guide for Improving Indoor Air Quality in Commercial/ Public Buildings During Wildland Fire Smoke Events***. This guidance is designed to help reduce indoor exposure to pollutants from wildland fire smoke events, including prescribed burns (1). These pollutants present serious health risks, notably to children (5).

The EPA guidance explicitly covers schools, with school administrators and facility managers among its intended audiences (1). It offers a less technical approach to smoke readiness than the recommendations in ASHRAE Guideline 44-2024 (1). Still, it is lengthy and detailed.

This summary aims to raise school communities' smoke-readiness awareness by providing an accessible, high-level overview of the guidance, with a focus on content relevant to schools.

Quoted language and parenthetical page numbers refer to the guidance, unless otherwise cited. Additional resources and full citations appear at the end. This summary is an educational resource and not a substitute for expert advice.

Stages of Smoke Readiness

In addition to providing background information, the EPA's guidance offers advice on three stages of smoke readiness.

Before a Smoke Event

A Smoke-Ready Plan is developed based on assessment of building-specific usage and characteristics. Smoke-preparedness actions are undertaken.

During a Smoke Event

Preplanned smoke-mode actions are implemented by the Smoke-Ready Plan team, with adjustments as needed.

After a Smoke Event

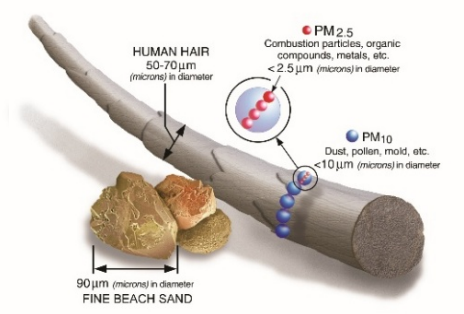
Normal operations and readiness are restored. The Smoke-Ready Plan is revised based on lessons learned.

Wildfire Smoke Events Pose Significant Risks to Human Health

Wildland Fire Smoke

"Wildland fire" refers to both unplanned and planned fires that occur in "wildland vegetation." Unplanned fires can be caused by "lightning or other natural causes or by human ignitions, accidental or intentional." Planned fires are those "intentionally ignited to meet land management objectives" such as ecosystem health and vegetation control (1).

Ordinarily, planned fires are designed to minimize "smoke impacts to population centers." They also usually last only hours to days, while unplanned fires may burn for weeks to months depending on weather conditions. But both types of fires create smoke that can have adverse human health impacts (1, 5).



Particulate matter (PM) size **(Source: EPA, 2026a)**

Smoke consists of particles and gases from the burning of plants and trees, and also structures and vehicles, if the wildfire reaches the wildland urban interface (WUI) (4). These include:

- fine (PM2.5) and coarse (PM10-2.5) particulate matter, based on diameter in microns/micrometers (µm)
- polycyclic aromatic hydrocarbons (PAHs)
- pollutant gases like carbon dioxide (CO2), carbon monoxide (CO), and nitrogen oxides (NOx)
- volatile organic compounds (VOCs) (4-5)

Smoke-Related Health Impacts

PM2.5 particles are far smaller in diameter than a grain of sand or human hair. When inhaled, they can "penetrate deep into the lungs and enter the bloodstream" (4). PM2.5 is the "main PM component of smoke." Based on "extensive scientific evidence," it is the smoke "pollutant of greatest concern" for human health (4-5).

Short-term exposure to PM can cause:

- "airway inflammation" and respiratory symptoms like "breathing issues, coughing, wheezing, [and] chest tightness" (5)
- "reduction in pulmonary function" and, in some persons, more severe issues, including heart attacks and strokes (5)

VOC exposure can irritate the eyes, nose, and throat and lead to headaches, nausea, and dizziness. Prolonged exposure can harm bodily function and has also been linked to cancer (5).

Some populations are at greater risk of smoke-related health impacts because of chronic health conditions, life stage, pregnancy, or socio-economic factors. The last group includes people who work outdoors, lack access to adequate housing or mitigation measures, or have limited health care resources (5).

Children: An At-Risk Population

As a population, children under age 18 are at greater risk from smoke. They "spend more time outdoors and inhale more air per pound of body weight" than adults. Still-growing lungs mean they are also "more susceptible to breathing problems such as coughing, wheezing, chest tightness, and decreased lung function" (5).

Managing Smoke Impacts Begins by Understanding Background Considerations and Data

Indoors Aren't Always Safe from Smoke

While people are advised to stay inside and "keep doors and windows closed" during smoke events, smoke can still be a hazard indoors (10).

Smoke can seep, or "infiltrate," through cracks, gaps, and other openings in a building's envelope. It can enter through a heating, ventilation, or air conditioning (HVAC) system if it is set to bring in outdoor air (9-10).

Negative pressure from exhausts in spaces like bathrooms and kitchens can also result in smoke being drawn into a building (10).

Smoke-readiness planning can help ensure safer indoor air for all building occupants.

Factors Affecting Indoor Smoke Risk

Three main factors affect indoor smoke risk. Two factors—"occupant behavior" and "building characteristics"—can be assessed and planned around to limit the impact of smoke indoors.

Occupant behavior includes how HVAC systems and air cleaners are maintained and operated, whether windows and doors are opened or closed, and how spaces are used during smoke events (9).

Building characteristics encompass how vulnerable a specific building's envelope is to infiltration, and how any HVAC systems in the building are designed and constructed (9).

A third factor that affects indoor smoke risk, "local smoke properties and behavior," is outside of facility managers' control (9). However, familiarity with "smoke information sources" can help increase smoke readiness (6-8).

Outdoor Air Quality Data and Risk

Smoke information sources can be used to anticipate when building occupants may be at risk from smoke-filled air coming indoors (6).

The EPA's AirNow website and mobile phone app provide information on current PM2.5 levels, active fires, smoke conditions, and alerts by location (7). Other sources listed in the guidance also offer historical, outlook, and alert information (7-9).

The EPA's Air Quality Index (AQI) converts pollutant concentrations in outdoor air to a "number on a scale from 0 to 500." Values are tiered into levels with recommended actions to avoid health impacts for "everyone," as well as "unusually sensitive" and "sensitive" groups. The index levels and PM-related recommended actions included in the EPA's guidance are shown below (6).

Air Quality Levels of Concern (values of index)	Recommended Actions
Good (0-50)	**Everyone:** Don't see or smell smoke? It's a good time to open windows or go outdoors.
Moderate (51-100)	**Everyone:** Don't see or smell smoke? It's OK to open windows or go outdoors. **Unusually Sensitive People:** Consider making outdoor activities light and short. Go inside to cleaner air if you have symptoms.
Unhealthy for Sensitive Groups (101-150)	**Everyone:** Consider lighter and shorter outdoor activities. **Sensitive Groups:** Go inside to cleaner air if you have symptoms.
Unhealthy (151-200)	**Everyone:** Keep outdoor activities light and short. Go inside to cleaner air if you have symptoms. **Sensitive Groups:** Consider moving all activities inside. Go inside to cleaner air if you have symptoms.
Very Unhealthy (201-300)	**Everyone:** Limit outdoor physical activity. Go inside to cleaner air if you have symptoms. **Sensitive Groups:** Avoid all outdoor physical activity.
Hazardous (301-500)	**Everyone:** Avoid all outdoor physical activity. **Sensitive Groups:** Stay indoors and keep activity levels light. Stay indoors and consider creating a cleaner air room.

The EPA also counsels "close attention" to federal and state occupational health and safety recommendations and standards when building occupants include employees (7).[1]

[1] Other recommendations and standards may also be applicable (7). For example, California interagency wildfire smoke guidance classifies all school-aged children as belonging to a "sensitive group" (CDE et al., 2024).

Planning Ahead Helps Protect Building Occupants from Smoke Risk

Smoke Readiness Is Widely Needed

School administrators and facility managers can use smoke information sources to help identify if and when their buildings are likely to be impacted by smoke events. Some parts of the United States, like California, are generally "prone to wildfires" (7). However, even in areas without a clear fire season, smoke-readiness planning is still important. Prescribed burns may occur in these areas. Further, under specific weather conditions, "smoke can travel hundreds to thousands of miles" and affect the air quality of regions far away from wildfires, sometimes for weeks (7-8).

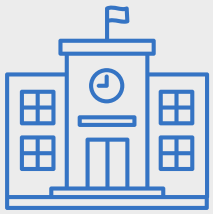
Planning Should Start Early

Development of a "Smoke-Ready Plan"—a written "list of actions to take before, during, and after a smoke event"—should occur "well before [an] event occurs" (1, 11). Early planning ensures not only general readiness but also that:

- the plan can take into account relevant building-specific factors, including "building type, existing infrastructure (such as HVAC systems or the number of openable windows and doors), building use, occupant behavior," and "at-risk groups" (10-11, 51)
- qualified HVAC experts can be consulted "prior to investing in significant changes" (11)
- necessary building and system checks and repairs can be made, equipment procured, and supplies stocked (52-53)
- an "implementation team" can be formed, with member roles and responsibilities, as well as communications channels, defined and documented in advance (52)
- triggers for "smoke mode" can be set (52)
- key smoke-mitigation strategies can be identified, tested, and refined (52-53)
- there is time for plan distribution and "clear understanding of effective actions and staff duties and responsibilities" (12-13, 52)

In Appendix 1, the guidance includes a Smoke-Ready Plan template divided into three sections with checklists. They cover planning and preparation, implementation (smoke mode), and post-smoke event actions (50-55, 61).

Schools as Cleaner Air Centers



The EPA guidance summarized here does not cover the topic of schools as community cleaner air centers. However, other EPA resources recognize that in some communities, schools may play this role for students' families, "specified at-risk members of the nearby neighborhood," or other members of the public (EPA, 2023).

In such communities, smoke-readiness planning can take into account, as part of building assessment, whether a specific space might be designated to serve as a cleaner air center. Relevant considerations include ability to accommodate high occupant density; HVAC capacity; "permanent or temporary standby power capability"; and impact on "normal school operations or function."

Planning for community usage requires engagement with stakeholders from the broader community, in addition to those from the school district.

Before a Smoke Event: Developing and Testing a Smoke-Ready Plan

Initial Steps to Take

The EPA recommends the following initial steps when developing a Smoke-Ready Plan:

- "predict the building usage during smoke episodes"
- "assess the [building's] current state"
- define the plan's checklist elements
- test the plan (50)

Building Usage Assessment

Assessing how a building is likely to be used during a smoke event is critical to determining what measures are needed. Relevant questions include what spaces will be used at what times, occupant density and activities, and which occupants are at greater risk (51).

Ventilation Assessment

The EPA advises different approaches to smoke-readiness planning depending on whether a building has central HVAC, standalone HVAC units, or no HVAC (2).

If some form of HVAC is present, it is important to understand what equipment and filter types serve what spaces and where air intakes and exhausts are located (12-24, 51).

HVAC components and controls should be assessed for proper functioning (17, 51). HVAC settings that minimize outdoor air intake, while maintaining adequate temperature, odor, and pressure control, should be determined (17-19, 51). "Existing building documentation" and manufacturer or expert consultation may be helpful (17, 51-52).

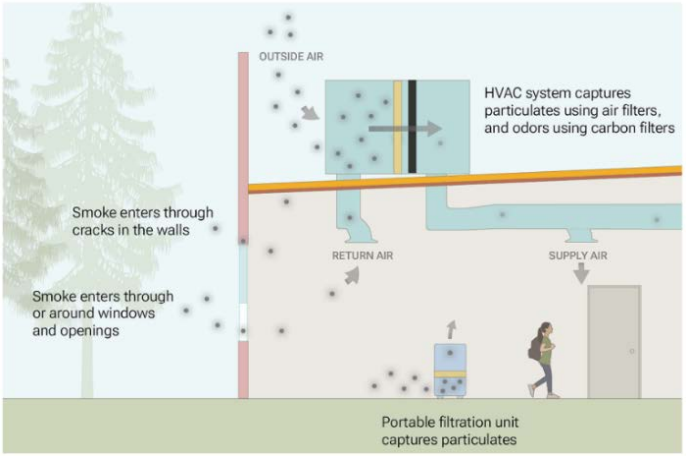
If HVAC systems are absent or can't adequately filter harmful smoke components from the air, sourcing and deployment of portable air cleaners (PACs) should be explored (31, 53).

Building Envelope Assessment

A walk-through inspection of both the building exterior *and* interior can identify "smoke entry points" to be addressed (27, 52). These may include windows, doors, vents, fans, skylights, siding, hatches, baseboards, soffits, electrical outlets, service areas, and plumbing features (27, 52). "Obvious maintenance issues" like cracks or gaps should also be flagged and repairs made (52). Opportunities to close off smoke entry points by changing settings, modifying activities, or altering occupant behaviors—for example, around open doors and windows—should be noted (27-29, 52). Actionable items for when a building enters smoke mode can then be formulated (26-29, 52).

Smoke-Ready Teams and Triggers

The EPA's Smoke-Ready Plan template emphasizes the importance of forming a smoke-ready implementation team, and documenting member roles, responsibilities, and communications, as well as what wildfire or air quality data will trigger smoke mode (52).



Smoke interacting with a building **(Source: EPA, 2023)**

Four Key Smoke-Readiness Strategies

The EPA's guidance focuses on four key strategies: HVAC systems improvements, building usage and weatherization adjustments, PACs, and air quality sensors (10-11). Specific actions will depend on building-specific usage and characteristics. The table below lists sample actions that show how these strategies can inform a Smoke-Ready Plan's checklists for before, during, and after a smoke event.

Testing Smoke Readiness

Once assessments have been conducted, repairs made, equipment and supplies stocked, and smoke-mode settings and occupant-behavior adjustments determined, the Smoke-Ready Plan can be tested with a trial run. This involves implementing plan elements to see how they work, then switching back to normal operating mode (52-53). Testing is critical to ensure that a building will be ready for an actual smoke event.

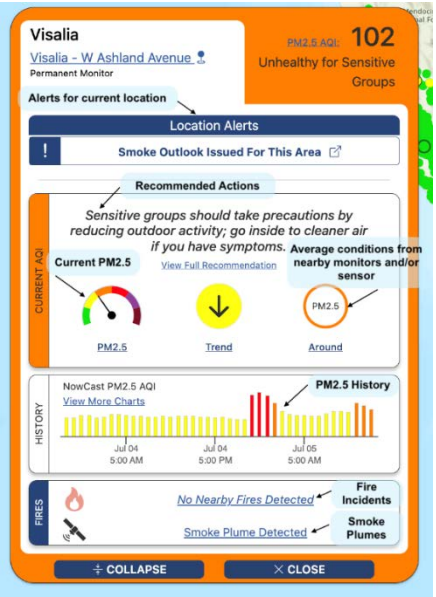
Four Key Smoke-Readiness Strategies

HVAC systems improvements 	• Inventory and maintain HVAC systems and components (12-17) • Determine settings to minimize outdoor air intake while ensuring temperature control, positive pressure, and general safety, consulting qualified HVAC professionals as needed (12, 17-19, 51) • Stock and install MERV 13 or higher HVAC filters, or the highest MERV-rated filters that systems can handle (20-25, 51-54) • Adjust dampers, relief/exhaust fans, and system settings (14-19, 54) • After smoke events, restore default settings, air out building, check and change filters, and replenish stocks (12-13, 22-23, 25, 55)
Building usage and weatherization adjustments 	• Identify potential smoke entry points (26-28, 52) • Repair cracks, gaps, and other building envelope leaks (26-28, 52) • Assess occupancy and behaviors that can affect indoor air quality, notably indoor pollution-generating activities and use of windows and doors, and make necessary smoke-mode adjustments, while ensuring "evacuation safety and accessibility" (28-29, 51-52, 58) • If HVAC is absent, consider air cleaning and cooling measures, including PACs, portable cooling units, and fans (2, 31, 39-40, 51)
Portable air cleaners (PACs) 	• Decide if PACs are needed to remove particles and/or gases (30-31) • Calculate the clean air delivery rate (CADR) and number of PACs needed for any spaces where they will be deployed (30, 34-37) • Procure PACs and replacement filters (31-38) • Deploy PACs and run them "at all times" during occupancy (31) • Maintain PACs, including proper filter replacement (37, 38-39)
Air quality sensors 	• Procure sensors (plus accessories) suited to monitoring needs, siting, and power, connectivity, and data services considerations (41-47, 60) • Deploy and test sensors before a smoke event to check functionality and precision and collect baseline data (41, 45-47, 61, 71-75) • Use thermostat, PM, and/or CO2 sensors to gauge temperature, particulate levels, and ventilation, and make data-based adjustments before, during, and after smoke events (47, 54, 60-62) • Maintain and ensure continued performance of sensors (41, 45-47)

During a Smoke Event: Going into Smoke Mode

Triggering Smoke Mode

The Smoke-Ready Plan should document what data will trigger entry into smoke mode (52). The trigger level might be, for example, perceptible smoke or a set AQI value for PM2.5 or a Smoke Forecast Outlook (7, 61). Sources to be consulted, such as AirNow, may be identified (61). Legal standards, such as worker safety regulations, and agency recommendations may be relevant to the trigger-level parameters (7). A smoke-ready team member can be assigned to monitor air quality and determine whether the trigger level has been met (61).



AirNow Fire and Smoke Map **(Source: EPA, n.d.)**

Smoke-Mode Actions

Once the trigger level has been met, actions on the Smoke-Ready Plan's smoke-mode checklist should be implemented by assigned team members. Examples of actions might include:

- make adjustments to HVAC such as minimizing outdoor air intake, increasing run time, and modifying dampers and relief and exhaust fans (17-19, 54)
- check for positive pressure (18, 54)
- install higher-efficiency or supplemental filters, if not already in place (20, 23, 54)
- deploy PACs, if not already in operation (30, 54)
- create a cleaner air room (39-40, 54)
- alert occupants to modify behaviors through signs and other communications (29, 61)
- undertake "quick fixes as needed" like weather stripping and caulking (61)
- use sensors to check indoor air quality against pre-smoke event baseline and AQI data (22, 46-48, 54, 61)
- shift strategy based on sensor data (61)

Duration of Smoke Mode

Smoke mode should continue until air quality has returned to normal and normal operations can safely be restored. However, in places with frequent or prolonged smoke events, some smoke-mode measures may be implemented seasonally, or even permanently (17).

Creating Cleaner Air Rooms

A specific "isolated space within a building" may be set up with PACs, and cooling equipment if needed, to provide extra protection for "those at greater risk from health complications due to smoke," including children (39, 68). One or more PACs should be used to deliver clean air sufficient for the room size (40). Doors and windows should be kept closed, while maintaining "clear exits," and indoor pollution-generating activities avoided (40).

After a Smoke Event: Restoring Normal Operations and Readiness

Completing the Plan Cycle

Once risk to occupants has passed, smoke mode can be exited (17). However, execution of the Smoke-Ready Plan is not finished.

Team members should implement the plan's checklist items for after a smoke event (1, 55). Examples of actions might include:

- restore HVAC systems to documented normal settings, including normal outdoor air intake, and verify success (12-13, 17, 19, 55)
- reverse any modifications to dampers or relief and exhaust fans (55)
- inspect and replace HVAC filters as needed, and remove and store any temporary supplemental filters (12, 23, 25, 55)
- air out the building by increasing outdoor air intake, running PACs, and/or opening doors and windows (12, 13, 31, 55)
- normalize building usage, including "full use of windows or doors" (26, 28-29)
- repair any leaks discovered during the smoke event (26, 28)
- replace PAC filters as needed, and store PAC units if not regularly used (26, 55)
- replenish HVAC and PAC filters and other supply stocks (12, 23, 25, 55)
- inspect and clean air quality sensors (41, 55)

Fire danger sign **(Photo: J. Harris, 2026)**

Fine-Tuning with Lessons Learned

Each building's specific requirements are "unique," and "not every strategy" will work in every situation (10-11). Once a smoke event has ended and operations have been normalized, it is useful to take stock and revise the Smoke-Ready Plan with lessons learned (55). Notably, air quality sensor data from the smoke event can be evaluated to determine how well different smoke-mode measures worked, so that refinements can be made (30, 39, 41, 47).

The Broad Benefits of Smoke Readiness for Schools

Smoke-readiness planning and measures can deliver a broad range of benefits to school communities. Understanding and improving building usage, weatherization, ventilation, filtration, and cooling can help protect school occupants from health risks associated not only with smoke but also with other air pollution, airborne viruses, water intrusion, and pests (3, 5-6, 9, 18, 26, 40). These actions can also increase efficiency and reduce energy costs (26).

Additional Smoke-Readiness Resources

To raise school communities' smoke-readiness awareness, this summary has introduced the EPA's *Best Practices Guide for Improving Indoor Air Quality in Commercial/Public Buildings During Wildland Fire Smoke Events*. Clean Air Allies hopes that this resource has provided useful information in an accessible format. However, by design, it is a high-level, non-exhaustive overview.

Readers interested in further exploring smoke-readiness planning and related indoor air quality measures will find more detailed information in the nearly 80-page guidance document. Of particular note are the sample Smoke-Ready Plans in Appendix 1 (50-62).

Following are additional resources that may be of interest to those with varying levels of expertise. Both broad and deep knowledge of wildfire smoke readiness can help keep schoolchildren, teachers, and other staff safe.

EPA, *Webinar: Managing Indoor Air Quality Before and During Wildfire Smoke Events: Smoke-Ready Schools* **(2025):** Addresses children's vulnerability to smoke exposure and how schools can plan for and manage indoor air quality during wildfire smoke events, including a case study.

EPA, *Wildfires and Indoor Air Quality in Schools and Commercial Buildings* **(2026):** Compiles a variety of EPA resources related to wildfire-smoke management strategies, including factsheets on schools as community cleaner air and cooling centers.

EPA et al., *Wildfire Smoke: A Guide for Public Health Officials* **(2026):** Includes information on the role of schools in broader public health strategy for preparations, exposure reduction, and communications around smoke events.

California Department of Education et al., *Memo: Get Smart about Wildfire Smoke - Guidelines for Schools and Wildfire Smoke* **(2024):** Provides interagency guidance on air quality-based activity restrictions, masks, HVAC, PACs, and school closure decision making.

University of California, Davis College of Engineering and California Department of Public Health, *Indoor Air Quality Video Lessons* **(2024):** Communicates both general and technical information on a range of indoor air quality topics, including wildfire smoke events, in a user-friendly video format.

Stanford Woods Institute for the Environment, *In Pursuit of Clean Air: Laying the Groundwork for Public School Resilience to Wildfire Smoke* **(2023):** Explores different dimensions of public school smoke readiness, including community collaboration, policy, and protective measures.

ASHRAE, *ASHRAE Guideline 44-2024: Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events* **(2024):** Offers detailed technical recommendations on building smoke-readiness risk assessment and planning, design and operations, and communications and training.

National Collaborating Centre for Environmental Health, *A public health companion for ASHRAE Guideline 44: Protecting building occupants from smoke during wildfire and prescribed burn events* **(2025):** From a Canadian public health agency, supports public officials in understanding key components of ASHRAE Guideline 44; includes smoke-ready checklists.

Remember: Consulting with qualified professionals is often important for achieving building-specific smoke readiness (11, 12, 20, 26-27).

Full Citations

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CLEAN AIR
Allies

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Clean Air Allies is a nonprofit organization dedicated to increasing access to healthy indoor air in Prekindergarten through Grade 12 (PK-12) schools. For more information, please visit cleanairallies.org.