

Improving Ventilation and Indoor Air Quality During Wildfire Smoke Events

Recommendations for Schools, Homes, and Other Non-Healthcare Facilities with Mechanical Ventilation

Wildfire Smoke Contaminants in Indoor Air

Wildfire smoke is a complex mixture of particulate matter and gases, including carbon monoxide (CO), volatile organic compounds (VOCs), and ground-level ozone (O₃).

- Particulate matter consists of solid particles and liquid droplets suspended in the air. Particles with diameters less than 10 micrometers (PM₁₀) are upper respiratory tract and eye irritants.
- Smaller particles (PM_{2.5}) are an important health concern. They can be inhaled deep into the lungs and affect respiratory and heart health.
- CO, a colorless, odorless gas, is a particular health concern in dense wildfire smoke or in close proximity to a fire.
- Some VOCs and ground-level O₃ can also be health concerns in smoky environments.

Outdoor air pollutants, including smoke, enter and leave buildings in three main ways:

1. **Mechanical ventilation systems**, which actively draw in outdoor air through intake vents and distribute it throughout the building.
2. **Natural ventilation** through open doors or windows.
3. **Infiltration**, the passive entry of unfiltered outdoor air through small cracks and gaps, such as around windows and doors.

Tightly closed buildings reduce exposure to outdoor air pollution. Upgrade the filter efficiency of the heating, ventilation, and air conditioning (HVAC) system and change filters frequently during periods of smoke to improve indoor air quality. Supplement with [high efficiency particulate air \(HEPA\) portable air cleaners](#).

See below for steps to take before and during a wildfire smoke event. Additional answers to frequently asked questions about wildfire smoke are available on DOH's [Smoke from Fires webpage](#).

Upgrading and Maintaining HVAC Filters

Upgrade the filters in an existing HVAC system to improve indoor air quality. This can allow you to leave outdoor air intake vents open during some pollution events. Filters are available at hardware stores and online.

- Have your HVAC technician evaluate whether a higher minimum efficiency reporting value (MERV) filter rating can be used. A MERV 13 filter or higher is recommended.
- Prolong the life of a MERV 13 filter. Ask your HVAC technician about installing a lower-rated filter upstream to capture large particles.
- Select a filter with the deepest pleat your system can accommodate—two inches or more—to reduce the air resistance across the filter and improve filtration.
- MERV-rated filters remove particles but not “smoke smell” or most gases. Carbon filters can be added to reduce some gaseous air pollutants.

Proper installation, operation, and maintenance are critical for effective use of air filters.

- Make sure the filter fits tightly in the frame to prevent air from bypassing the filter.
- Check the filter at least every month during heavy use to ensure it is not thickly loaded with particles. Check more often in heavy or prolonged smoke conditions.
- Replace the filter following manufacturer recommendations. If the filter appears heavily soiled when you replace it, consider changing it more frequently.

Preparing for Smoke Events

- Know how to adjust your HVAC system or window air conditioner to keep smoke out. Examples may include turning off “fresh air mode” or closing the outside air intake. [Consider cooling options \(PDF\)](#) that will not bring in smoke.
- Conduct a pre-wildfire season checkup to ensure all equipment will operate properly and back-up filters are available.
- Have multiple sets of higher efficiency filters for smoke events on hand because they may not be available during a smoke event due to increased demand.
- Consider using HEPA portable air cleaners to supplement the work of the HVAC system by removing PM_{2.5}. Air cleaners with carbon filters can remove gaseous contaminants, including some VOCs. See [DOH’s Choosing a Portable Air Cleaner guidance](#) for more information.
- Buildings other than homes should have a wildfire smoke readiness plan. If your building has a building automation system, consider adding a “smoke event” mode to manage outside air intakes. Consult [ASHRAE’s Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events](#) for more information.

During a Smoke Event

When outside air is in the Unhealthy for Sensitive Groups category for PM_{2.5} pollution (see the [Washington Smoke Information website](#) and [Department of Ecology Air Quality Map](#)):

- Close all windows and limit use of outside doors to keep smoke-related pollutants out. Windows may need to be opened periodically if indoor heat levels become a concern. If opening windows to manage heat, make sure it is cooler outside than inside.
- Close outside air intakes unless MERV 13 or higher rated filters are installed.
- During long-term smoke events, bring in outside air during periods of improved air quality, such as during rain or shifts in wind. This will help reduce the levels of carbon dioxide (CO₂) and indoor air pollutants that can build when outside air intakes are shut. Monitor CO₂ levels with the goal of keeping levels below 800 ppm. If levels are frequently above 1000 ppm, considering increasing outdoor air ventilation.
- To reduce smoke particles that stick to surfaces in the building and the chemicals they release, damp mop with microfiber cloths and use HEPA-filtering vacuums.
- Reduce sources of indoor air pollutants, such as fragranced products, gas, propane or wood-burning stoves, smoking, and vaping.
- Keep system fans running continuously to help filter the air. [Consider using HEPA portable air cleaners](#).
- For schools, if possible, monitor indoor PM_{2.5} levels. Identify areas with better indoor air quality to inform air cleaning and activity decisions. See [Wildfire Smoke Guidance for Canceling Events or Activities and Closing Schools \(PDF\)](#) and “Indoor Air Quality Monitoring” in the [Washington Children and Youth Activities Guide for Air Quality](#).
- In dense wildfire smoke or in close proximity to a fire, consider using a CO monitor that can detect levels as low as a few ppm. Most hardware store CO alarms only detect potentially life-threatening levels of CO. Aim to keep CO levels below an average of 20 ppm over 1 hour. Learn more at [CO & Health, California Air Resources Board](#).

More Resources

- [Smoke from Fires](#) (available in multiple languages)
- [Washington Children and Youth Activities Guide for Air Quality \(PDF\)](#)
- [Wildfire Smoke - Partner Toolkit](#)
- [Wildfire Smoke Guide for Public Health Officials \(PDF\)](#)
- [Wildfires and Indoor Air Quality, U.S. EPA](#)
- [Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events, ASHRAE \(PDF\)](#)

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