

Improving Ventilation and Indoor Air Quality During Wildfire Smoke Events

Recommendations for Schools, Homes, and Other Buildings 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 microns (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 produced by incomplete combustion, 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** from 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. Upgrading the filter efficiency of the heating, ventilating, and air-conditioning (HVAC) system and changing filters frequently during periods of smoke greatly improves indoor air quality. Supplementing with High Efficiency Particulate Air (HEPA) portable air cleaners improves air quality even more.

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

Upgrading the filters on existing HVAC systems helps improve indoor air quality and can allow you to leave HVAC outdoor air intake vents open during some pollution events.

- Have your HVAC technician evaluate whether a higher MERV filter rating can be used. A MERV 13 filter or higher is recommended.
- 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. Filters with high density activated carbon can be added to reduce some other 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 for buildup at least every month during heavy use to ensure it is not thickly loaded with dust. Check more often in heavy smoke conditions or prolonged smoke events.
- Replace the filter following manufacturer recommendations. If the filter appears heavily soiled when you replace it, consider changing it more frequently.
- To prolong the life of a filter and prevent rapid overloading, discuss with your HVAC technician installing a low-efficiency pre-filter upstream.

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 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 due to increased demand.
- Consider using a HEPA portable air cleaner to supplement the work of the HVAC system by removing PM_{2.5}. Additional specialized filters can be added to the air cleaner to 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 (BAS), 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 Monitoring Map](#)):

- Close all windows and limit use of outside doors to keep smoke-related pollutants out.

- Close outside air intakes unless MERV 13 or higher rated filters are installed to help filter out smoke particles.
- During long-term smoke events, take advantage of periods of improved air quality (such as during rain or shifts in wind) to use natural ventilation to flush out the building. This will help reduce the levels of CO₂ that can build when outside air intakes are shut. Ideally, keep CO₂ levels below ~700-800 ppm for dilution and better indoor air quality.
- To reduce smoke particles that stick to surfaces in the building and the chemicals they off-gas, damp mop with microfiber cloths and use HEPA-filtering vacuums.
- Reduce all sources of indoor air pollutants, such as use of fragranced products, gas, propane or wood-burning stoves, smoking, and vaping.
- Keep system fans running continuously to help filter the air.
- For schools, if possible, monitor indoor PM_{2.5} levels to identify areas with worse or better indoor air quality, to inform air cleaning strategies, and to inform activity decisions. See “Indoor PM_{2.5} Measurements in Schools” in [Wildfire Smoke Guidance for Canceling Events or Activities and Closing Schools \(PDF\)](#) and Appendix B of the [Washington Children and Youth Activities Guide for Air Quality](#) for more information.
- 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 [California Air Resources Board, CO & Health](#).

More Resources

- [Smoke from Fires](#), DOH
- [Indoor Air Quality Program](#), DOH
- [School Environmental Health & Safety Program](#), DOH
- [Wildfire Smoke Guide for Public Health Officials \(PDF\)](#), DOH
- [Wildfires and Indoor Air Quality](#), EPA
- [Wildfires and Indoor Air Quality in Schools and Commercial Buildings](#), EPA
- [Planning Framework for Protecting Commercial Building Occupants from Smoke During Wildfire Events](#), ASHRAE (PDF)

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