LOCAL PUBLIC HEALTH OFFICERS

Wildfire Smoke

Guidance for Canceling Outdoor Events or Activities and Closing Schools

Washington State Department of HEALTH

DEPARTMENT OF ECOLOGY State of Washington

DOH 334-428 June 2025 CS

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Suggested Citation
Washington State Departments of Health and Ecology. “Wildfire Smoke Guidance for Canceling Events or Activities and Closing Schools” Olympia, WA; June 2025.

Current air quality and forecasts

Current outdoor $PM_{2.5}$ levels from agency monitors are available as Air Quality Index (AQI) Values that are updated hourly on the Washington Smoke Blog and EPA's AirNow App. Forecasts are also increasingly available during wildfire season on the WA Smoke Blog and Washington State Department of Ecology's Smoke Forecast website. Low-cost $PM_{2.5}$ sensors can provide helpful information outdoors where there is not a nearby agency monitor and indoors, where there are no agency monitors, though these are less accurate than agency monitors and uncorrected sensor measurements should not be directly compared to $PM_{2.5}$ action levels. Publicly reported $PM_{2.5}$ outdoor sensor measurements with an applied smoke correction factor are also available on the WA Smoke Blog and EPA's Fire and Smoke map.

Introduction

The Washington state departments of Health and Ecology have been asked about when to cancel outdoor events and activities or close schools due to wildfire smoke impacts on public health. Decisions about closures, relocations, or evacuations are made at the local level in Washington. This document provides guidance for local health officers about air concentrations of smoke, measured as fine particulate matter (PM2.5), considered a health threat. While this document is written for wildfire smoke, it can be informative for other sources of PM2.5. Keep in mind that pollution from different sources may have varying toxicity.

Recommendations and action thresholds are not static, and additional factors should always be considered, including individual sensitivities, levels of exposure, and other circumstances; communities disproportionately impacted by wildfire smoke and other air pollution; and ability to access cleaner indoor air.

Recommended particulate matter action levels for closures and cancellations

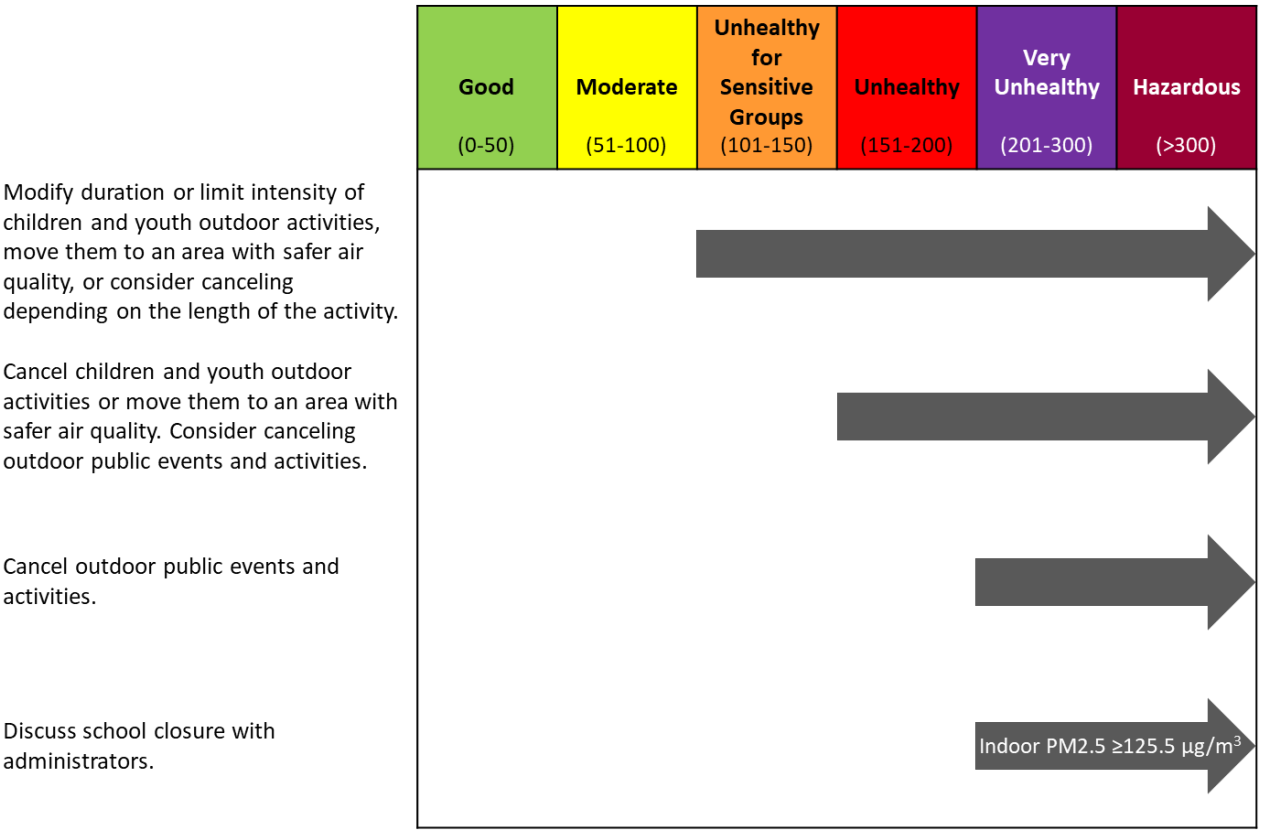
When the current or forecasted outdoor AQI for $PM_{2.5}$:

- Equals or exceeds an AQI value of 101 ("Unhealthy for Sensitive Groups" category or worse), modify duration or limit intensity of children and youth outdoor activities, move them to an area with safer air quality, or consider canceling depending on the length of the activity.
- Equals or exceeds an AQI value of 151 ("Unhealthy" category or worse), cancel children and youth outdoor activities or move them to an area with safer air quality. Consider canceling outdoor public events and activities.

- Equals or exceeds an AQI value of 201 ("Very Unhealthy" category or worse), cancel outdoor public events and activities.
- When school is in session and <u>indoor</u> $PM_{2.5}$ concentrations:
- Equal or exceed 125.5 µg/m^3 (indoor equivalent to AQI value 201 and "Very Unhealthy" category or worse), discuss school closure with administrators.

$PM_{2.5}$ concentrations are reported across six health hazard levels in the AQI. The $PM_{2.5}$ action levels described here are each at a cut-point of a hazard level. The AQI is designed for outdoor pollutants, though the school closure action level is based on an indoor $PM_{2.5}$ concentration with an equivalent AQI value in the absence of established hazard levels for the general public designed for indoor use.

Figure 1. AQI thresholds for recommended closures and cancellations



Factors to consider for cancelling outdoor events and activities, and closing schools

In addition to the $PM_{2.5}$ action levels, consider other factors and issues specific to your area when deciding about closures and cancellations to protect health and welfare.

Outdoor Events and Activities

- What is the forecast for how long wildfire smoke levels will remain high?
- Are smoke conditions getting worse, getting better, or staying about the same?
- Is there an option to relocate to an area with cleaner air?
- Will the event include people at increased risk for smoke impacts?
- If children or others requiring care are involved, will adults be available as caretakers?
- Will there be impacts on economic or job security by canceling the activity or event?
- Are there other weather factors to consider, like excessive heat or humidity, that would further increase risk from outdoor exposure?
- Is the visibility safe for driving?

Schools

- What is the forecast for how long wildfire smoke levels will remain high?
- Have all options to improve indoor air quality been attempted?
- Are students and staff who are sensitive to smoke allowed to stay home if it is safer?
- Is it safe to walk or bike to school?
- Is the visibility safe for driving?
- Are there other weather factors to consider, like excessive heat or humidity, that would further increase health risks?
- Where will children be relocated if schools are closed? Is the air quality better there?
- If children or others requiring care are involved, will adults be available as caretakers?
- Will there be impacts to economic or job security for parents missing work to attend to children?
- While moving to another location, will people be more exposed outdoors than if they had just stayed indoors?
- Are there other safety concerns about relocating people?

Steps to reduce smoke exposures

- Reduce outdoor time and activities.
- Stay indoors and keep indoor air as clean as possible.
- Keep windows closed and only allow entry of outside air through filtration.
- Restrict use of outside doors; double door entries can help keep smoke out.
- Wildfires often occur on hot days, and many schools and other indoor facilities do not have air conditioning. Pay attention to the heat and take steps to cool buildings.
- For more information:
    - Improving Ventilation and Indoor Air Quality during Wildfire Smoke Events (PDF)
    - DOH Smoke from Fires
    - Cooling indoor spaces without air conditioning

Measuring wildfire smoke levels

The concentration of $PM_{2.5}$ – particles less than 2.5 micrometers in diameter – is the most useful measurement of smoke levels to protect health. The Department of Ecology (Ecology), local clean air agencies, and Tribes routinely monitor these levels outdoors. $PM_{2.5}$ concentrations are grouped into health hazard levels within the U.S. Environmental Protection Agency's (EPA) Air Quality Index (AQI) six categories (Figure 1). Health precautions in each category are based on current conditions weighted to "24 hour-like" average concentrations. AQI values are from hourly monitored concentrations using EPA's NowCast algorithm.

NowCast particulate matter ($PM_{2.5}$) concentrations use averages of between 3 and 12 hours that can be compared to 24-hour standards and health indexes. EPAs' NowCast algorithm is designed to respond when air quality conditions are rapidly changing, which is common during wildfire smoke events. NowCast concentrations use longer averaging times when air quality is stable, and shorter averaging times when conditions are changing quickly. NowCast concentrations, unlike hourly data, are suitable for comparison with federal standards and the AQI.

Outdoor measurements, trends and forecasts

Three key pieces of information about smoke conditions are available on public agency websites and apps: the current $PM_{2.5}$ AQI, current $PM_{2.5}$ trends (whether smoke conditions are getting worse, getting better, or staying the same), and smoke forecasts. Whenever possible, decision-making around canceling outdoor events and activities, closing facilities or relocating people should consider all three pieces of information. Forecasts more than two days in the future should be used with caution, as they have greater uncertainty.

The Washington Smoke Blog is the recommended public agency website for accessing information on current conditions, trends, and forecasts, as it provides all three in a single map. On a smartphone, EPA's AirNow is the recommended app, though its forecasts are limited to most parts of Washington. Users who do not see forecast information in their area on the AirNow app can also refer to Ecology's smoke forecast, which covers the whole state. Instructions for all these resources are provided below.

Outdoor Air Sensors

The map on the Washington Smoke Blog and on the EPA AirNow app (smoke tab) shows agency monitoring sites as larger circles, temporary monitors as medium-size circles labeled with a "T", and publicly reporting $PM_{2.5}$ low-cost sensors as smaller circles. Low-cost $PM_{2.5}$ sensors are small devices available commercially. They are generally less accurate than agency monitors, and since many are operated by members of the public, their performance, siting, and maintenance are unknown. Though EPA conducts some limited quality control screening on sensor data and applies a correction factor to account for known sensor bias for smoke, sensor data has greater uncertainty and is generally lower quality than agency monitoring data. One exception is the SensWA sensors, which are low-cost sensors operated by Ecology. The data from SensWA sensors is generally more reliable than other low-cost sensors.

Where available, nearby agency monitors are the best data source. However, agency monitors may also represent different smoke conditions if they are at a different elevation or in a different type of environment. In places far from agency monitors, nearby air sensors are likely better data sources than distant agency monitors. However, sensor data should be interpreted with caution, especially when one sensor shows very different values than other nearby sensors. Considering values from multiple nearby sensors and using SensWA sensors specifically can help offset the greater uncertainty of sensor measurements.

Recommended Website: Washington Smoke Blog

To see the current $PM_{2.5}$ AQI and trend using the Washington Smoke Blog map:

- Click the agency monitor or sensor closest to the area of interest.
- A pop-up will appear that indicates the $PM_{2.5}$ AQI value, trend, recent hourly data, and recommended health actions.
- SensWA sensors can be identified by looking at the label in the top left corner of the pop-up. SensWA sensors can also be selected in the map settings.

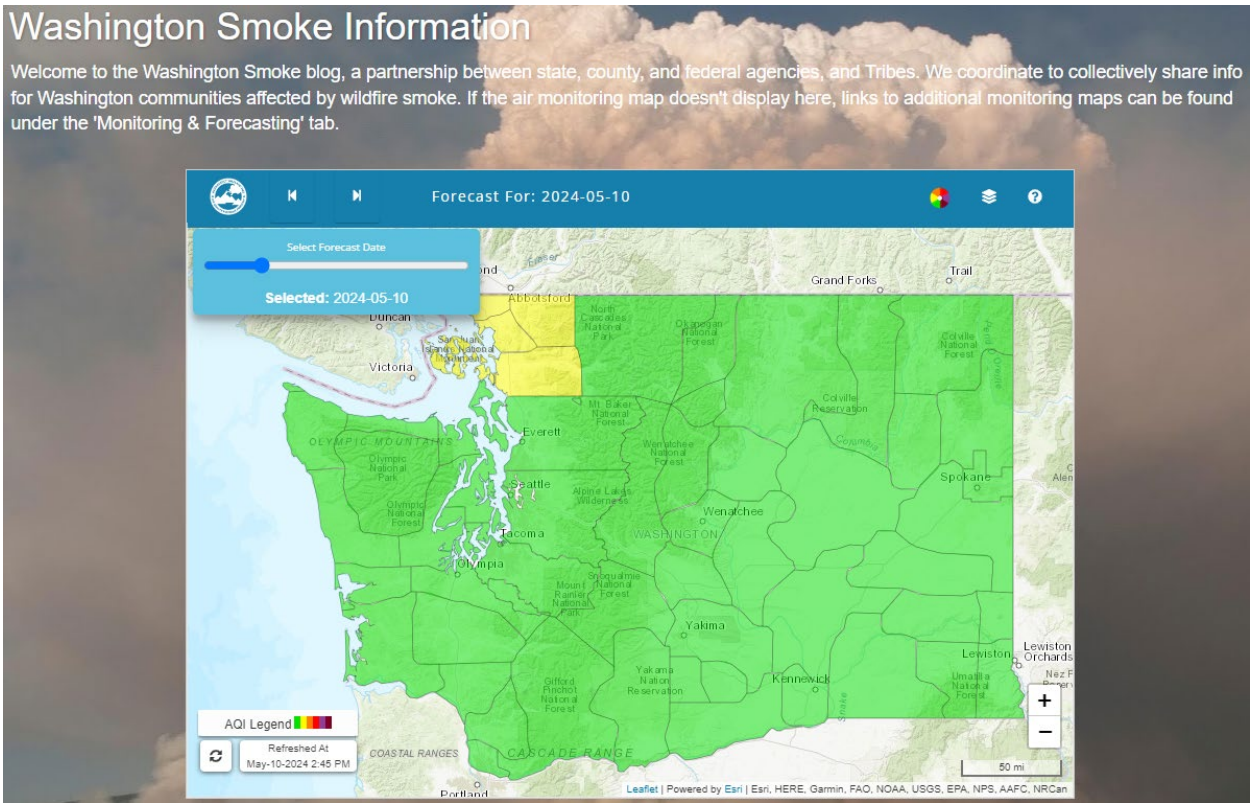
Additional features shown on the map include: fire icons for large fire incidents, small glowing points for satellite fire detections, and gray polygons for smoke plume locations.

Figure 2. Washington Smoke Blog map pop-up

To see the smoke forecast:

- Close any visible pop-ups on the map.
- Under "Select Forecast Date" in the top left corner of the map, use the slider to advance the date to the desired forecast date.
- The shaded polygons on the map indicate the 24-hour $PM_{2.5}$ AQI category forecasted for the selected date.
- Note that the smoke forecast is only available during wildfire season.

Figure 3. Washington Smoke Blog forecast display



The Washington Smoke Blog also contains text and graphical discussions of statewide, regional, or local air quality forecasts when wildfire smoke events are in progress. The Monitoring and Forecasting tab on the blog contains more information on several available higher-resolution smoke simulations.

Recommended Smartphone App: EPA's AirNow

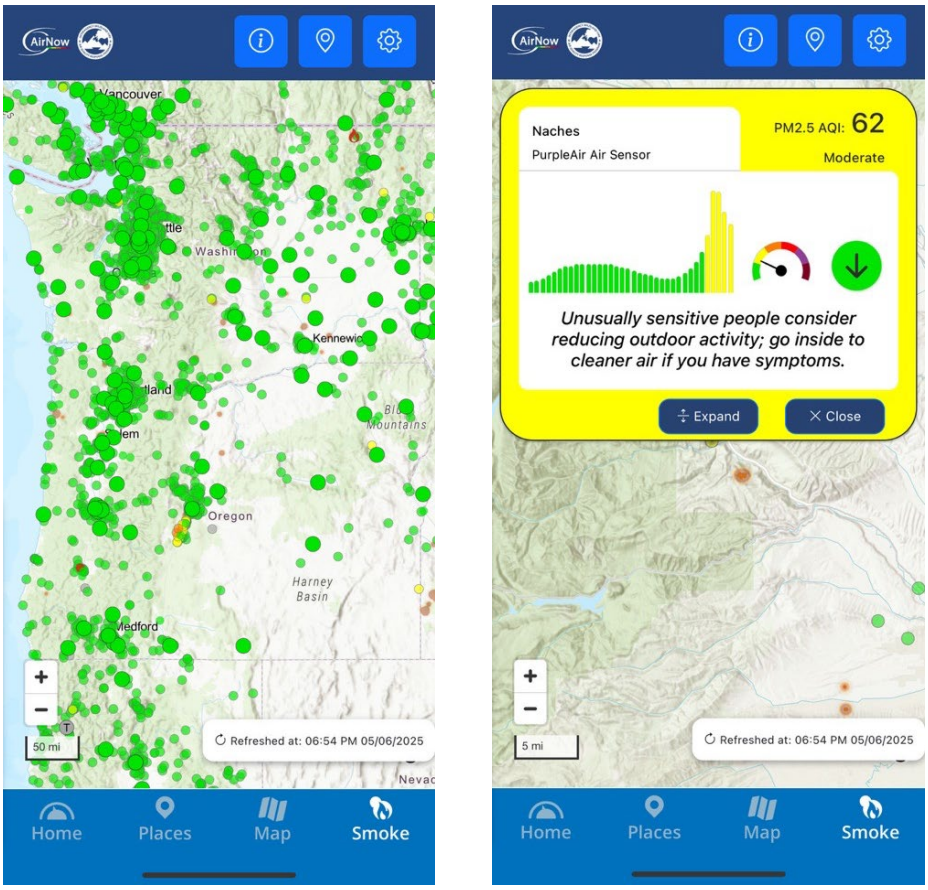
The landing page of EPA's AirNow app shows the current AQI and the daily forecast for some areas. Sometimes the current AQI is based on ground-level ozone or PM_{10} conditions instead of $PM_{2.5}$. Click "Details" below the AQI dial to see the AQI value for $PM_{2.5}$.

Figure 4. EPA's AirNow App home screen

For more detailed $PM_{2.5}$ monitoring data, click the "Smoke" button in the bottom right corner of the app. This map shows the same display of agency monitors and air sensors visible on the Washington Smoke Blog map.

- Click the agency monitor or sensor closest to the area of interest.
- A pop-up will appear that indicates the $PM_{2.5}$ AQI value, trend, recent hourly data, and recommended health actions.

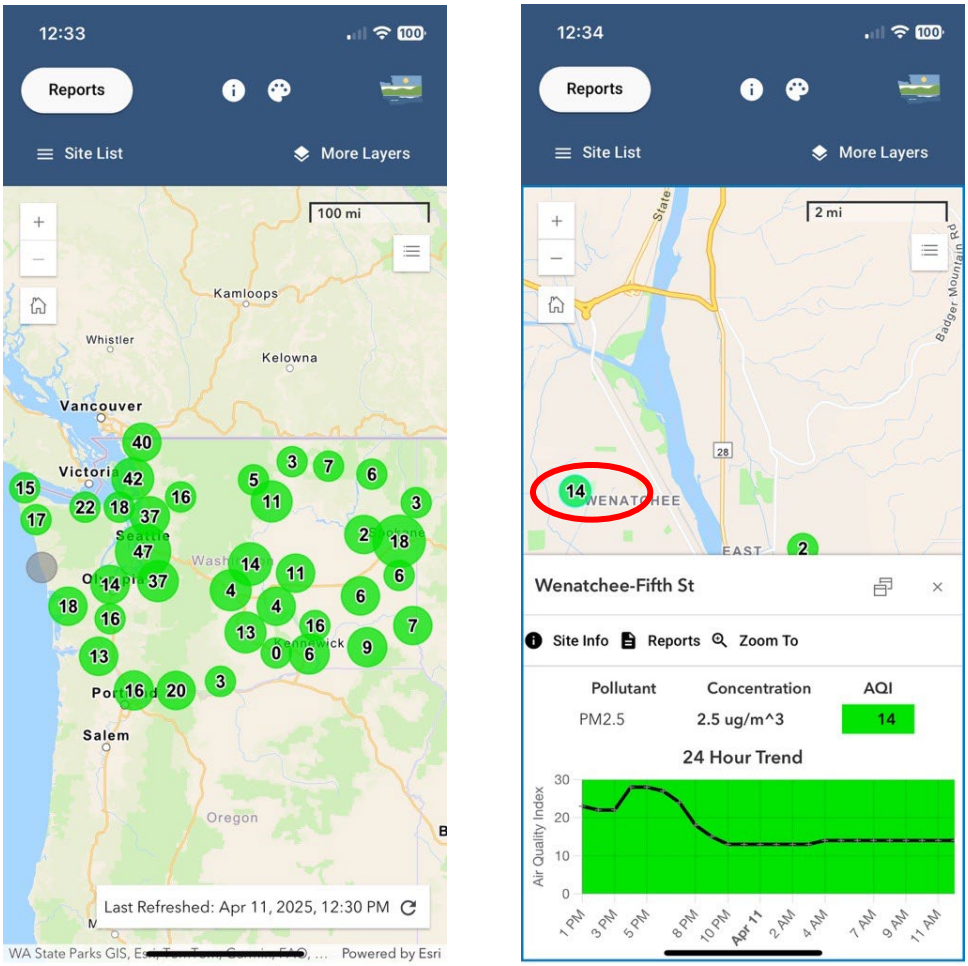
Figure 5. Accessing AQI values on EPA's AirNow App



Alternative Smartphone App: Ecology's Air Quality Washington App

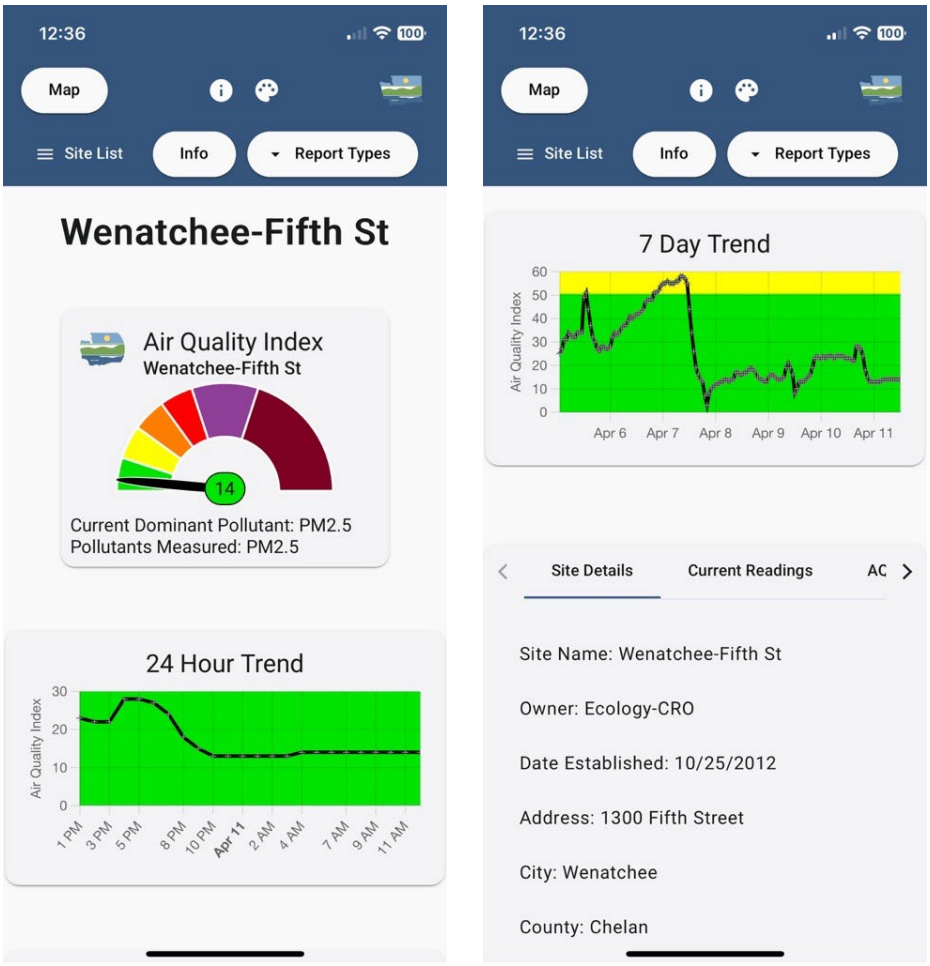
Ecology's air monitoring webpage is now available as a smartphone app for both iPhone and Android. It shows the current AQI and graphs of recent AQI conditions. The smoke forecast is also available as a map layer.

Figure 6. Home screen of Ecology's* Air Quality Washington App *(left) and example site popup (right).



Select a site by clicking the map to see its AQI and trend graph. Click on “Site Info” on the popup (circled in red in the screenshot above on the right) to access site details.

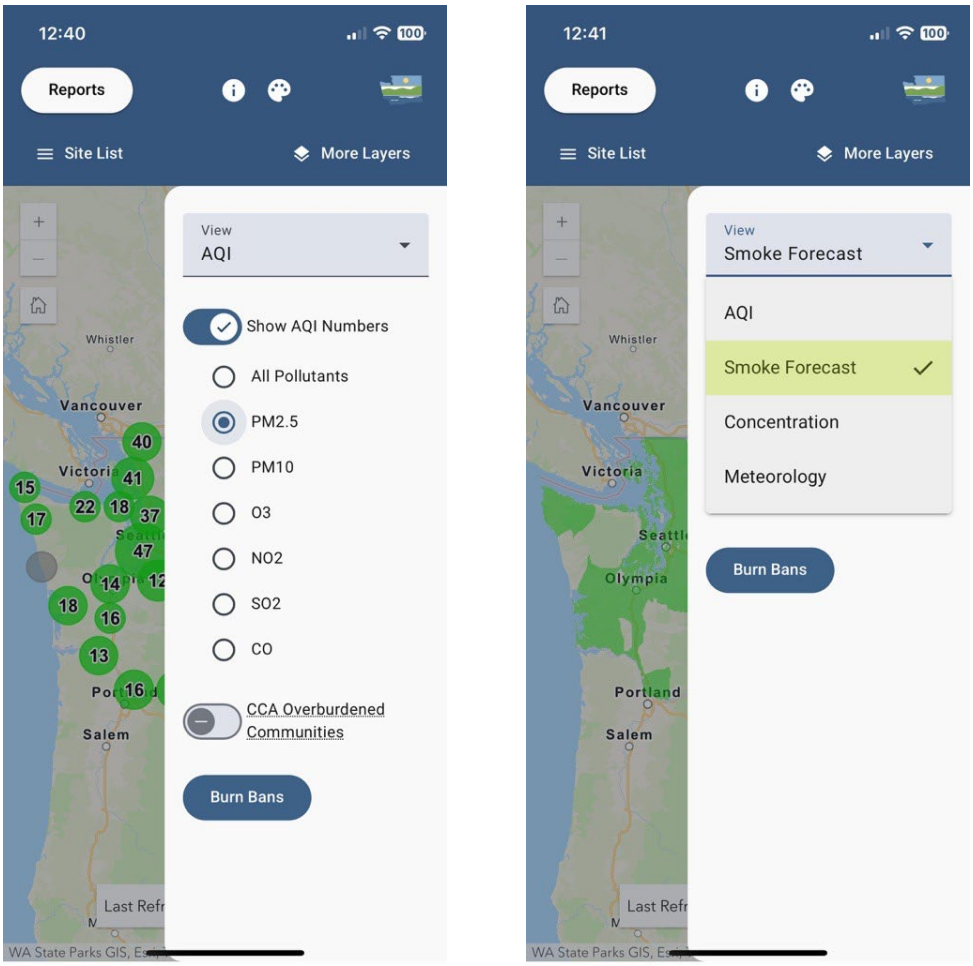
Figure 7. Example site details page showing 24-hour trend graph (left). Scroll down for 7-day trend graph and site details (right).



To limit the map view to the $PM_{2.5}$ AQI, click on “More Layers” in the top right corner of the home screen. Under “View” select “AQI” and then select “PM2.5” from the pollutant list.

To view the smoke forecast, click on “More Layers” in the top right corner of the home screen, and then under “View” select “Smoke Forecast.”

Figure 8. How to select PM2.5 AQI (left). How to view the smoke forecast (right).



Other websites and apps

$PM_{2.5}$ AQI values, trends and smoke forecasts are also available from other public agency websites and apps. The information from these resources and instructions for viewing the $PM_{2.5}$ AQI are summarized in **Table 1** on the following page.

Table 1. Summary of websites and apps providing monitoring data and forecasts

Resource	Instructions for viewing $PM_{2.5}$ AQI	Provides forecast?	Provides trend information?	Includes low-cost air sensor data?
Washington Smoke Blog Webpage	• $PM_{2.5}$ AQI is shown by default.	Yes. Use "Select Forecast Date" slider.	Yes, see "Trending" link on each site's popup.	Yes
Ecology's Air Monitoring Network Webpage and Progressive Web App* or Air Quality Washington App	• Select "$PM_{2.5}$" button at the top of the page. All monitoring sites report the $PM_{2.5}$ AQI.	Yes. See "Smoke Forecast" selection under "More Layers > View."	No	Only SensWA sensors
EPA Fire and Smoke Map Webpage	• $PM_{2.5}$ AQI is shown by default.	No	Yes, see "Trending" link on each site's popup.	Yes
EPA AirNow Webpage	• Default view shows combined ozone/PM AQI. Scroll down to "Current Air Quality" to see AQI for $PM_{2.5}$. • Click "Monitors Near Me" and check "Monitors" > "$PM_{2.5}$" in the top left to see the map of $PM_{2.5}$ monitoring sites.	Yes, only in some locations.	No	No
EPA AirNow App	• Default view shows combined ozone/PM AQI. Click "Details" under AQI dial to see AQI for $PM_{2.5}$.	Yes, only in some locations.	Only on "Smoke" map, click "Smoke" in the bottom right.	Yes, click "Smoke" in the bottom right.

*Ecology's webpage is a progressive web application. It can be saved as a shortcut on a smartphone home screen and will behave like a smartphone app.

A number of private companies also provide AQI values and forecasts through websites and apps, including popular weather apps. While some pull this information from EPA, others use proprietary methods that are not always accurate or transparent, and some use AQI breakpoints incorrectly. The public agency websites and apps listed above are recommended over private or third-party websites and apps to ensure that users have the most accurate information on smoke conditions and forecasts.

Indoor $PM_{2.5}$ Measurement in Schools

Low-cost $PM_{2.5}$ sensors can provide helpful information about indoor air quality in making decisions about school closures and school activities. While sensor measurements are less accurate than those from agency monitors, there are no agency monitors indoors, and correction factors can sometimes be used to increase accuracy. If using a correction factor is not possible, do not directly compare uncorrected sensor data to AQI breakpoints or $PM_{2.5}$ action levels. Instead, use sensor data to check how different parts of the school compare to each other and how indoor $PM_{2.5}$ levels compare to outdoor levels. When comparing indoors to outdoors, ensure both measures are uncorrected or using the same correction factors. Uncorrected sensor data can still indicate whether indoor concentrations are lower or higher than outdoor concentrations, whether some indoor spaces are cleaner than others, and how concentrations are changing over time.

Two strategies are helpful in evaluating indoor $PM_{2.5}$ levels in schools during periods of wildfire smoke.

1. **Assess variation in indoor air quality throughout the building(s) of the school (which may be due to variation in ventilation and filtration):**
    - Conduct a walk-around of the building(s) and outdoors using a portable sensor when outside $PM_{2.5}$ levels reach "Unhealthy for Sensitive Groups" (AQI value ≥ 101). Do this during times when the building is in use and ventilation is in normal operating conditions.
    - Select rooms where indoor air quality and ventilation, as well as children's activity levels are expected to vary. Include rooms used by children that are expected to have worse ventilation or indoor air quality (like no air filtration), rooms where physical activity is usually more vigorous (like the gym), rooms where external doors are opened frequently, and any external buildings (like portables).
    - In each room and outdoors, let the sensor measurements stabilize, then estimate average measurements over 5 to 10 minutes.
    - Complete the walk-around while outside $PM_{2.5}$ levels are stable, likely best achieved by completing within a few hours.
    - Determine the relative difference across the building(s) compared to outside $PM_{2.5}$ levels. For example, if the gym's indoor $PM_{2.5}$ level is 75 $\mu g/m^3$ and the outdoor $PM_{2.5}$ is 100 $\mu g/m^3$, then there is a 25% reduction of outdoor air

pollution in the gym. If a regular classroom's indoor $PM_{2.5}$ level is 50 µg/m^3 and the outdoor $PM_{2.5}$ is 100 µg/m^3, then there is a 50% reduction of outdoor air pollution in the classroom. This suggests that the classroom would have cleaner air than the gym.

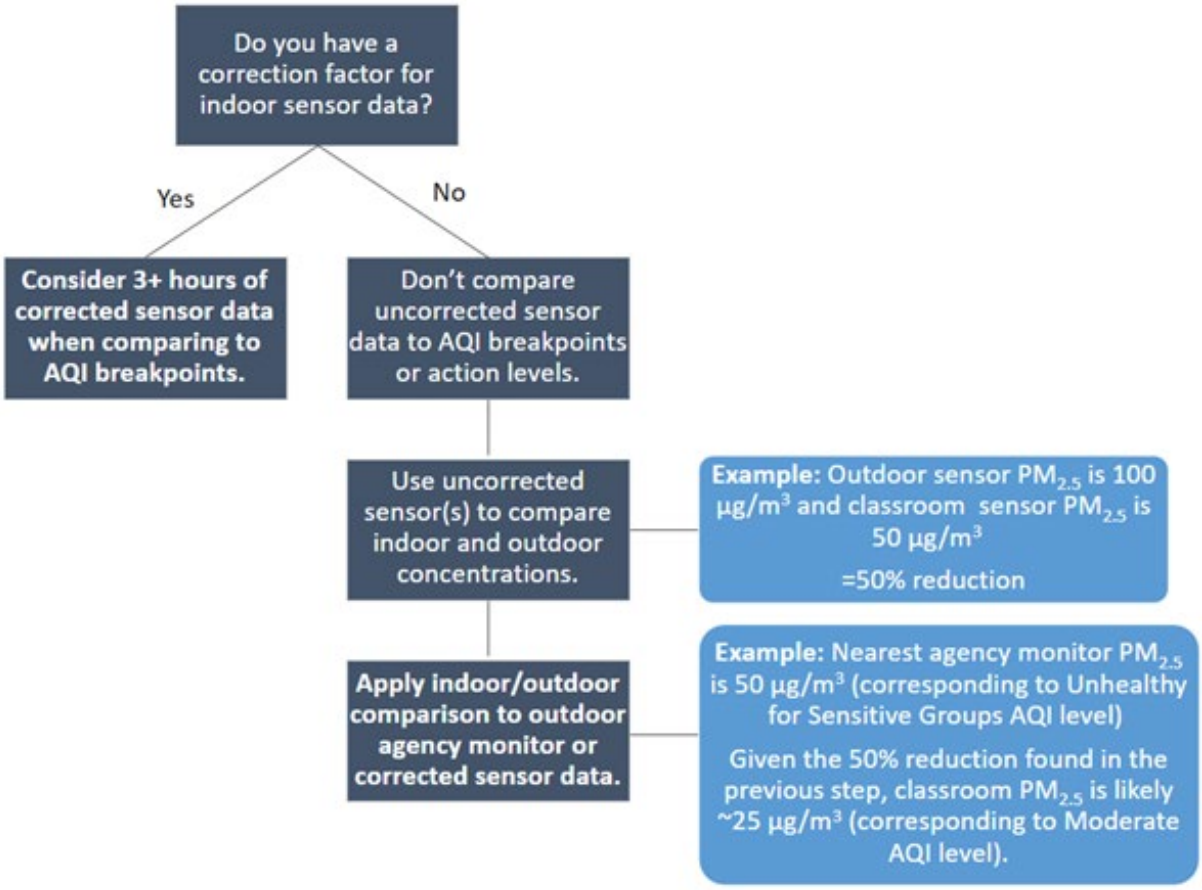
- Prioritize steps to reduce exposure in the rooms with highest $PM_{2.5}$ levels or relocate children away from these rooms to cleaner air spaces if necessary.
- If possible, repeat the walk-around throughout the poor air quality or smoke event. Also repeat the walk-around as needed if outside $PM_{2.5}$ levels increase or operating conditions change that would impact ventilation or indoor air quality. For example, if portable air cleaners are added, if windows cannot be kept closed, or if there are major changes in how the rooms are being used.

2. Track indoor air quality during wildfire smoke events:

- Place a stationary sensor in a room that is representative of the indoor air quality of the building(s) that has typical building use, and/or in a space with high physical activity levels or where students would go for indoor recess (like the gym). Avoid the cafeteria, where there are often sources of indoor PM2.5 from cooking.
- When outdoor $PM_{2.5}$ levels reach "Unhealthy for Sensitive Groups" (AQI value ≥ 101):
    - For school activities including games or practices, check the trend of indoor PM2.5 concentrations over time (i.e. whether smoke conditions are getting worse, getting better, or staying the same).
    - For decisions about school closures, check the one-hour averages of indoor PM2.5 concentrations over a period of 3 hours or more, and consider the forecast of outside PM2.5 for the day.
- Compare indoor stationary sensor measurements to outdoor stationary sensor measurements (ensure that either both are uncorrected, or they have the same correction factor). Then apply this comparison to the nearest agency monitor or SensWA. For example, if the indoor stationary sensor measurements are half of the outdoor stationary sensor measurements, assume that the indoor $PM_{2.5}$ concentrations are half of what the agency monitor or SensWA is reporting. If there is no outdoor stationary sensor, refer to the assessment from the walk-around (above) to determine the relative difference between the room with the indoor stationary sensor and outdoors (Figure 10). If there is no nearby agency monitor or SensWA, consider installing a publicly reporting outdoor stationary sensor that could show up on **the EPA Fire and Smoke Map** with a correction factor applied. Currently, outdoor Purple Air and Clarity sensors are displayed on the EPA Fire and Smoke Map. Other sensors may also be included on the map in the future.

- Refer to the assessment from the walk-around (above) to determine relative estimates of the $PM_{2.5}$ levels in other rooms throughout the building(s) compared to the room with the indoor stationary sensor.
- Prioritize efforts on reducing $PM_{2.5}$ levels in the rooms with highest levels or relocate children away from these rooms to cleaner air spaces if necessary.

Figure10. Decision tree for comparing sensor measurements to determine indoor PM2.5 concentrations



Check the performance evaluations developed by South Coast AQMD when selecting low-cost $PM_{2.5}$ sensors. A Field R^2 value near 1 and a relatively low Field MAE indicate a better-performing sensor, though even data from better-performing sensors may still need a correction factor applied to correct bias. Note that EPA's Fire and Smoke Map displays publicly reporting outdoor sensors (such as Purple Air) with a correction factor applied. The Fire and Smoke Map

does not show indoor sensors. If you are comparing indoor and outdoor measurements from sensors such as Purple Air, make sure you are comparing uncorrected indoor data to uncorrected outdoor data, or that the two are using the same correction factor. If you're not sure whether indoor $PM_{2.5}$ levels are lower than outside, assume levels are similar and take precautionary steps to reduce exposures. For technical assistance with indoor sensor measurements, contact: airquality@doh.wa.gov.

Other sources of $PM_{2.5}$ air pollution in Washington

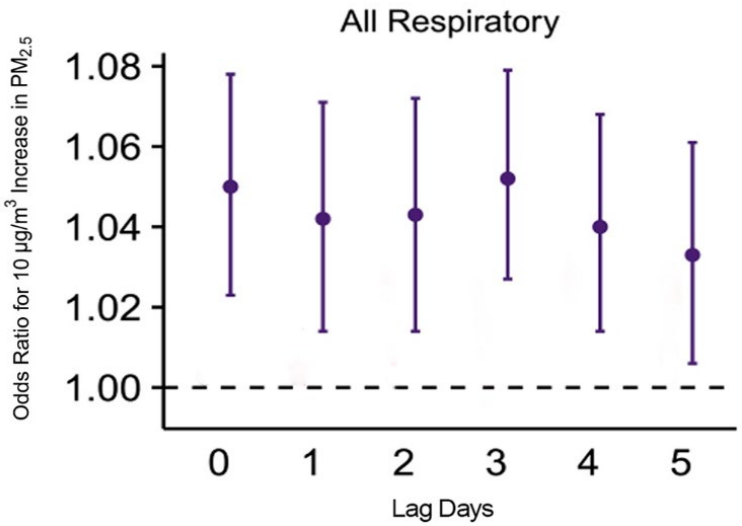
Major sources of $PM_{2.5}$ in Washington are wildfire, dust from tilling and harvesting, agricultural and silvicultural burning, residential wood burning, and industrial and mobile sources. There is concern about $PM_{2.5}$ from each of these sources of pollution. The chemical compositions can differ, and this can affect toxicity. There are also different seasonal patterns. For example, residential wood burning generally occurs over several months and contributes to routinely high $PM_{2.5}$ concentrations, particularly during cold and stagnant weather. In contrast, wildfire smoke tends to last for a few weeks and the $PM_{2.5}$ concentrations can have very high daily peaks. Some of the highest acute exposures to air pollution in Washington are from wildfire smoke.

Health Concern of Smoke Exposures

Exposure to wildfire smoke, like all smoke, can cause health problems. Minor symptoms include burning eyes, runny nose, coughing, and headaches. More severe effects include asthma attacks, COPD flare-ups, abnormal heart rhythms, heart attacks, and strokes. Several epidemiologic studies focusing on health impacts of wildfire smoke have been published recently, with just a few specific to Washington.

A study of Washington wildfire smoke impacts from fires in 2012 found that for a 10 $\mu g/m^3$ increase in $PM_{2.5}$ from wildfire smoke there is a 5% increased risk in same-day respiratory hospitalizations (odds ratio 1.052, 95% confidence interval 1.025-1.080) (Figure 11) [1]. The study found that, when focusing on specific respiratory impacts, there is an 8% increased risk for same-day asthma-related admissions for a 10 $\mu g/m^3$ increase in $PM_{2.5}$ from wildfire smoke (odds ratio 1.076, 95% confidence interval 1.019-1.136) [1].

Figure 11. Hospital admissions--wildfire smoke



Hospital admissions classified as emergency or urgent care associated with wildfire smoke exposures for a 10 µg/m^3 increase in $PM_{2.5}$ from wildfire smoke in Washington in 2012. Includes lag analysis (0-5 days).

Figure adapted from Gan et al. 2017; results limited to GWR estimation of smoke [1]

The state Department of Health (Health) collaborated with several local health jurisdictions in central Washington to examine emergency department and outpatient clinic visits during 2012 wildfires. Health found that average daily patient visits were 28% higher for cardiovascular disease and 18% higher for respiratory disease during wildfires, compared to the two-week period before wildfires [2]. The increased daily patient visits were most pronounced for respiratory disease in children [2].

A University of Washington study in collaboration with the departments of Ecology and Health investigated mortality and wildfire smoke in Washington from 2006 to 2017 [3]. The risk of dying from all non-traumatic deaths (i.e. not including accidents) was found to increase 2% the day after wildfire smoke compared to days without wildfire smoke. The increase remained two days after the smoke but was no longer statistically significant. In a sub-analysis, the risk of dying on the day of wildfire smoke was generally higher when focusing on respiratory causes of death.

A University of Washington study examined emergency department visits and wildfire smoke in Washington from 2017 to 2020 [4]. The risk of asthma emergency department visits increased 13% on the day of wildfire smoke exposure compared to days without wildfire smoke. This increase remained for the following five days. The risk of respiratory emergency department visits was also elevated on the five days following initial exposure. The study found mixed results for cardiovascular-related emergency visits by age group.

People with increased risk of adverse health effects when smoke levels are high include:

- People with lung diseases, such as asthma or chronic obstructive pulmonary disease (COPD), including chronic bronchitis, and emphysema.
- People with current or recent respiratory infections, such as COVID-19, pneumonia, acute bronchitis, bronchiolitis, colds, or flu.
- People with existing heart or circulatory problems, such as congestive heart failure or coronary artery disease.
- People with a prior history of heart attack or stroke.
- People with diabetes because they are more likely to have an undiagnosed cardiovascular disease.
- People 18 and younger because their lungs and airways are still developing, and they breathe more air per pound of body weight than adults.
- People older than 65 because they are more likely to have unrecognized heart or lung diseases.
- Pregnant people because of increased risk of poor health outcomes and pregnancy complications.
- People with access and functional needs who may need additional assistance due to any condition that may limit their ability to act in an emergency. .
- People who smoke because they are more likely to already have lower lung function and lung diseases.
- Outdoor workers because they often spend more time outside and are exposed to smoke longer.
- Communities of color because they have often experienced social and economic inequities which contribute to increased risk of poor health impacts from smoke.
- Tribal members and Indigenous peoples because they are often among frontline communities impacted first and worst from climate change hazards, including smoke.
- People with low income because they are more likely to have higher exposures and are less likely to have access to health care or to be able to afford interventions to reduce exposure.
- People who are unhoused or unsheltered because they often experience increased exposure to smoke and may not have access to social and health services.

For wildfire smoke and other air pollution exposures, a smaller portion of the population will suffer from the most severe health impacts, such as death and hospitalizations, and a larger portion of the population will suffer subclinical effects (headache, cough, eye irritation, and so on). The most severe impacts first occur in sensitive populations. However, as wildfire smoke exposures increase, more of the public will start to experience these severe impacts (Figure 12).

Figure 12. Range of health effects from wildfire smoke exposure

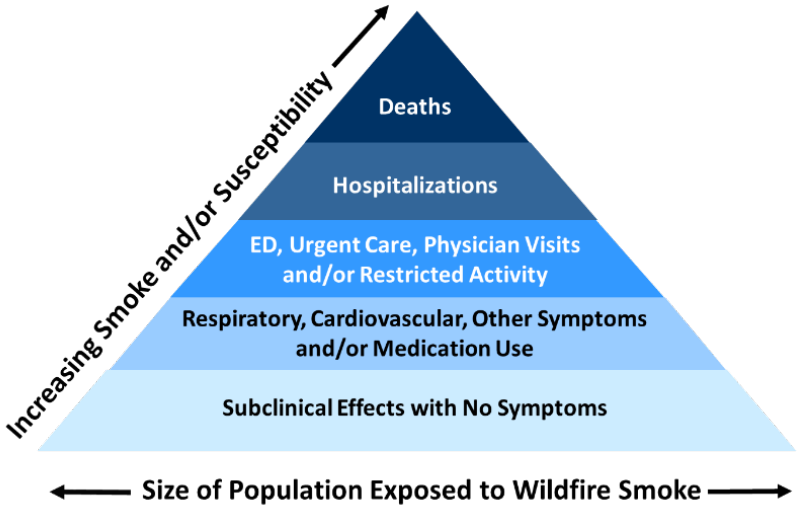


Figure adapted from Cascio 2018 [5]

Increasing evidence suggests that $PM_{2.5}$ from wildfire smoke may be more toxic than $PM_{2.5}$ from other sources [6], and that exposure to wildfire smoke is not experienced equally [7-9]. Most epidemiologic research of wildfire smoke focuses on acute health effects that occur within a week of elevated 24-hour $PM_{2.5}$ exposures. There is growing consensus that short-term exposure to wildfire smoke increases the risk of all-cause mortality, respiratory morbidity, including asthma and COPD exacerbations, and mixed evidence for cardiovascular morbidity [10]. Additionally, increasing evidence suggests short-term wildfire smoke exposure may be associated with adverse birth outcomes [11], and mental health impacts [12]. There is also evidence suggesting that wildfire smoke exposure increases the risk of respiratory infection, including for influenza [13], and for COVID-19 cases and mortality[14, 15]. In scenarios of short-term exposure to wildfire smoke, most people will likely recover a few weeks after inhalation of wildfire smoke. However, there may be some residual physical damage; thus, everyone should take steps to reduce exposure during wildfire smoke events. Communities in Washington are increasingly experiencing long-term exposure to wildfire smoke, combined with other smoke sources, such as residential wood burning and agricultural burning. There is a very limited body of research on long-term health effects of wildfire smoke exposure, indicating an increase in mental health impacts [16].

There is a much larger body of published research about $PM_{2.5}$ exposures from other sources of air pollution beyond wildfire smoke, and outside of Washington. Meta-analyses combining the results of several studies demonstrate that short-term increases in $PM_{2.5}$ from a wide range of sources are associated with higher rates of deaths and hospitalizations [17, 18]. Many of these deaths and hospitalizations are due to cardiovascular and respiratory effects. Increased cardiovascular

hospitalizations include congestive heart failure and ischemic heart disease [19]. Underlying respiratory diseases that are worsened include asthma, chronic obstructive pulmonary disease (COPD) and pneumonia [19]. In adults and children, research indicates that elevated exposures to $PM_{2.5}$ leads to poor lung function [20, 21]. Exposure to $PM_{2.5}$ in children may not only worsen asthma, but may lead to development of asthma [22]. While worsening heart and lung effects from $PM_{2.5}$ exposure have been studied the most, there is increasing evidence that $PM_{2.5}$ may also lead to several other effects, such as strokes [23], development of type 2 diabetes [24, 25], neurological and cognitive impairment [26, 27], and poor birth outcomes like pre-term delivery or babies born with low birth weight [28, 29]. Though there is less research about these impacts specific to wildfire smoke $PM_{2.5}$ exposures, the pattern of impacts appears similar to or worse than that of $PM_{2.5}$ from other sources.

Summary Guidance

- Summary Wildfire Smoke Guidance for Closing Schools
- Summary Wildfire Smoke Guidance for Canceling Outdoor Events or Activities

Air Quality and Public Health Guidance Resources

Figure 13. Washington Guide for Public Health Actions for Wildfire Smoke

Washington Guide for Public Health Actions for Wildfire Smoke

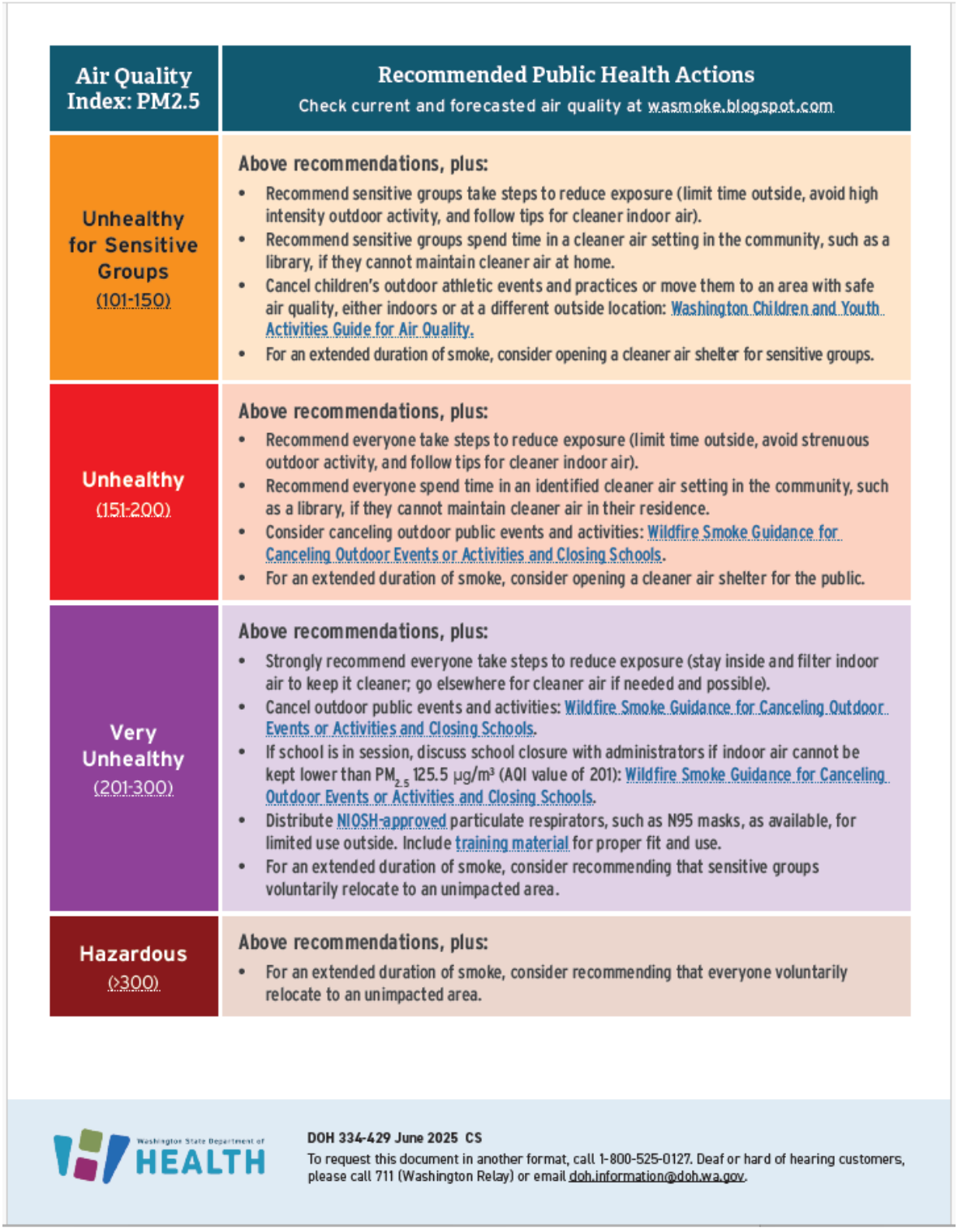
A guide for public health and other officials making local decisions regarding air quality in Washington

While this document is written for wildfire smoke, it can be informative for other sources of PM2.5. Keep in mind that pollution from different sources may have varying toxicity.

Recommendations and action thresholds are not static, and additional factors should always be considered, including individual sensitivities, levels of exposure, and other circumstances; communities disproportionately impacted by wildfire smoke and other air pollution; and ability to access cleaner indoor air.

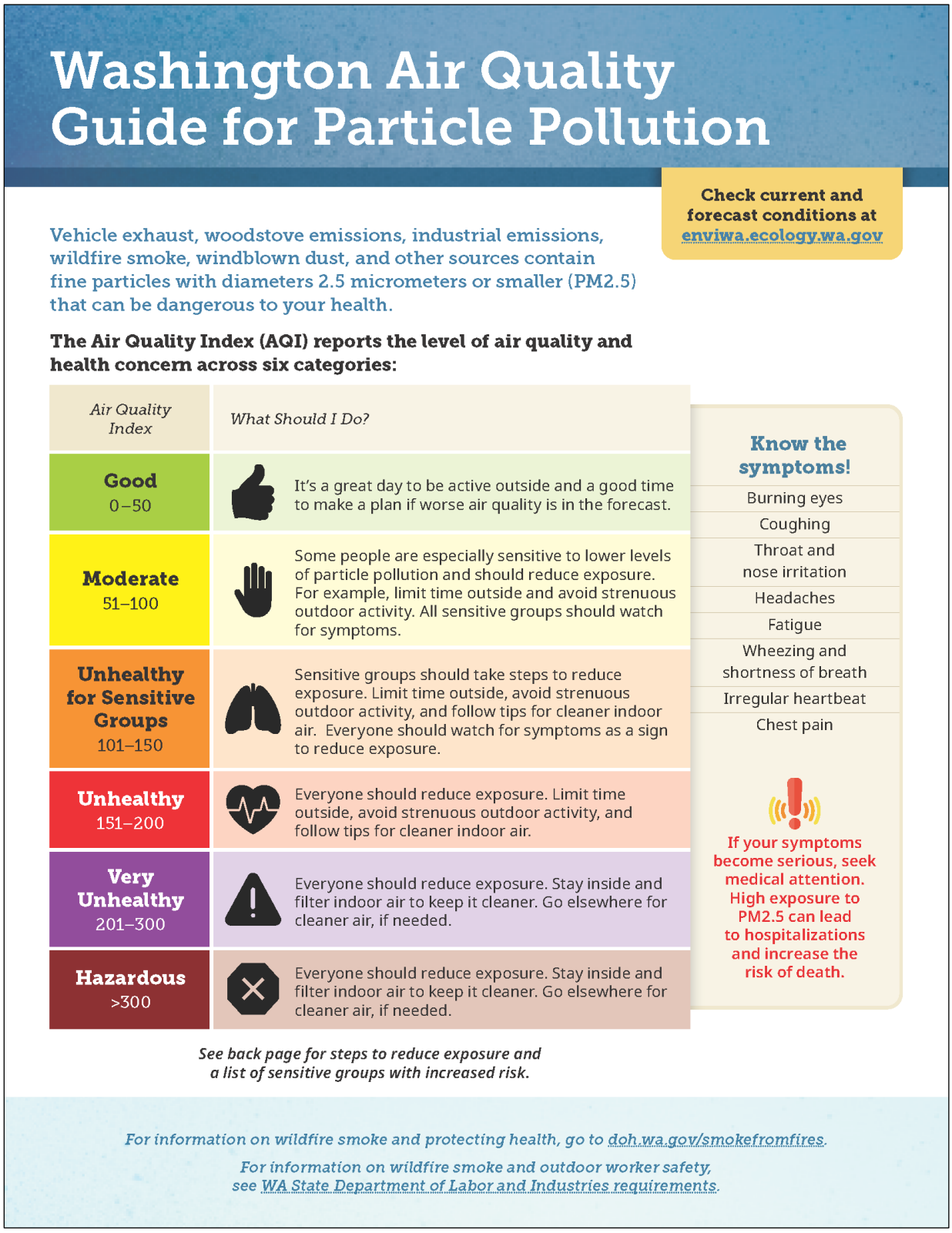
Air Quality Index: PM2.5	Recommended Public Health Actions Check current and forecasted air quality at wasmoke.blogspot.com
Good (0-50)	**Prior to wildfire season:** • Coordinate a local plan for public health actions and distribute preparedness information to the public. • Identify indoor spaces where individuals will seek cleaner air during wildfire smoke events and develop plans to protect indoor air quality, including filtration. » Indoor spaces used by sensitive groups, such as schools, child care facilities, and long-term care facilities. » Community cleaner air settings, such as libraries. » Temporary cleaner air shelters. **During wildfire season (late spring, summer, early fall):** • Monitor wildfires, smoke forecasts, and air quality at WA Smoke Blog. • If forecasts predict smoke in your area, review the Washington Wildfire Response document for Severe Smoke Episodes and the Wildfire Smoke Guide for Public Health Officials.
Moderate (51-100)	**Above recommendations, plus:** • Distribute health information to the public, including steps to take with health advisory categories: Washington Air Quality Guide for Particle Pollution. » Refer to the WA Smoke Blog for information about wildfires, smoke forecasts, and air quality. » Identify and focus outreach efforts for sensitive groups. • Coordinate with public health partners to follow recommended public health actions. • Recommend following the Washington Children and Youth Activities Guide for Air Quality. • For outdoor workers, start following WA Department of Labor and Industries' requirements.

(Figure 13 continued)



Air Quality Index: PM2.5	Recommended Public Health Actions Check current and forecasted air quality at wasmoke.blogspot.com
Unhealthy for Sensitive Groups (101-150)	**Above recommendations, plus:** • Recommend sensitive groups take steps to reduce exposure (limit time outside, avoid high intensity outdoor activity, and follow tips for cleaner indoor air). • Recommend sensitive groups spend time in a cleaner air setting in the community, such as a library, if they cannot maintain cleaner air at home. • Cancel children's outdoor athletic events and practices or move them to an area with safe air quality, either indoors or at a different outside location: Washington Children and Youth Activities Guide for Air Quality. • For an extended duration of smoke, consider opening a cleaner air shelter for sensitive groups.
Unhealthy (151-200)	**Above recommendations, plus:** • Recommend everyone take steps to reduce exposure (limit time outside, avoid strenuous outdoor activity, and follow tips for cleaner indoor air). • Recommend everyone spend time in an identified cleaner air setting in the community, such as a library, if they cannot maintain cleaner air in their residence. • Consider canceling outdoor public events and activities: Wildfire Smoke Guidance for Canceling Outdoor Events or Activities and Closing Schools. • For an extended duration of smoke, consider opening a cleaner air shelter for the public.
Very Unhealthy (201-300)	**Above recommendations, plus:** • Strongly recommend everyone take steps to reduce exposure (stay inside and filter indoor air to keep it cleaner; go elsewhere for cleaner air if needed and possible). • Cancel outdoor public events and activities: Wildfire Smoke Guidance for Canceling Outdoor Events or Activities and Closing Schools. • If school is in session, discuss school closure with administrators if indoor air cannot be kept lower than $PM_{2.5}$ 125.5 µg/m³ (AQI value of 201): Wildfire Smoke Guidance for Canceling Outdoor Events or Activities and Closing Schools. • Distribute NIOSH-approved particulate respirators, such as N95 masks, as available, for limited use outside. Include training material for proper fit and use. • For an extended duration of smoke, consider recommending that sensitive groups voluntarily relocate to an unimpacted area.
Hazardous (>300)	**Above recommendations, plus:** • For an extended duration of smoke, consider recommending that everyone voluntarily relocate to an unimpacted area.

Figure 14. Washington Air Quality Guide for Particle Pollution



(Figure 14 continued)

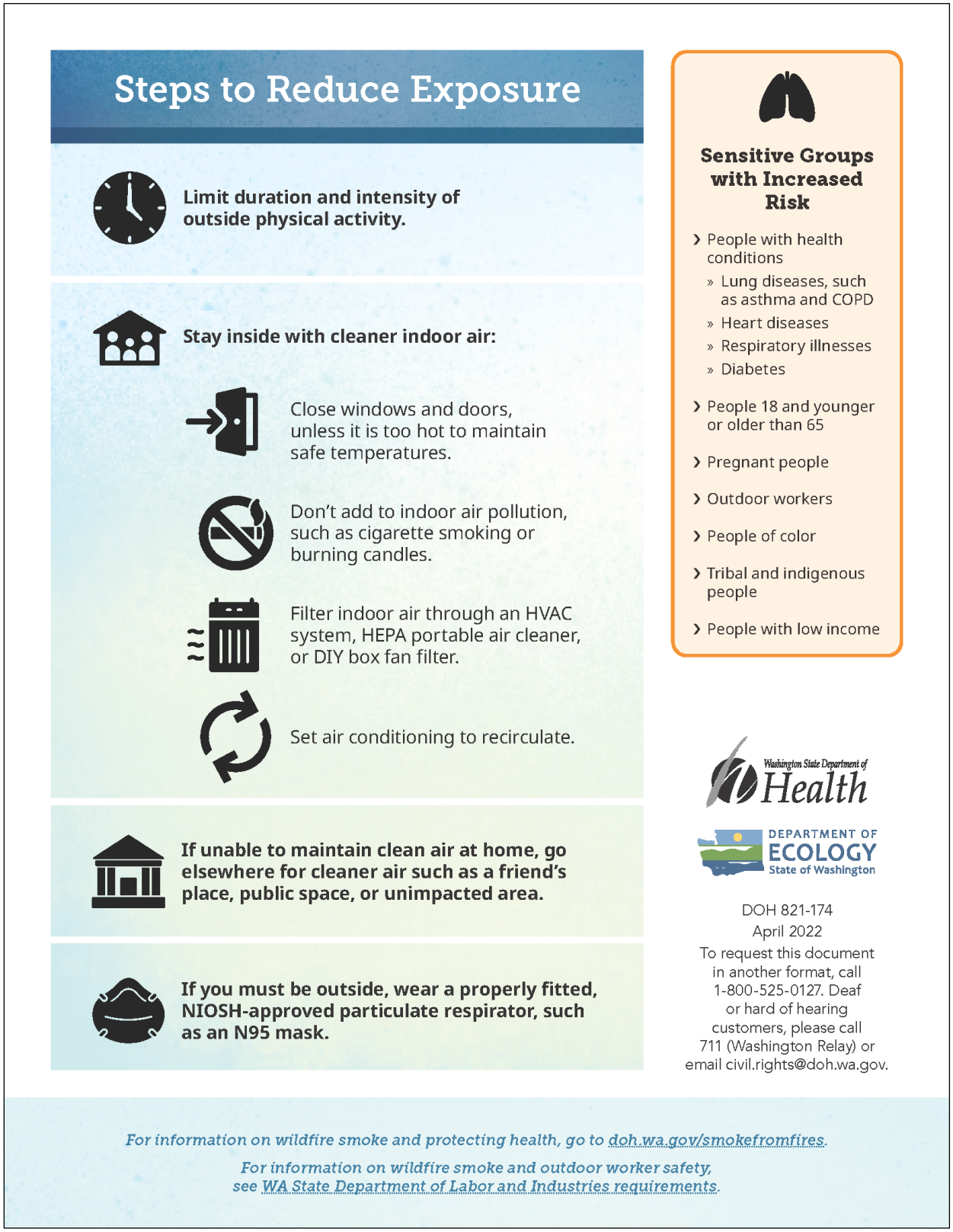
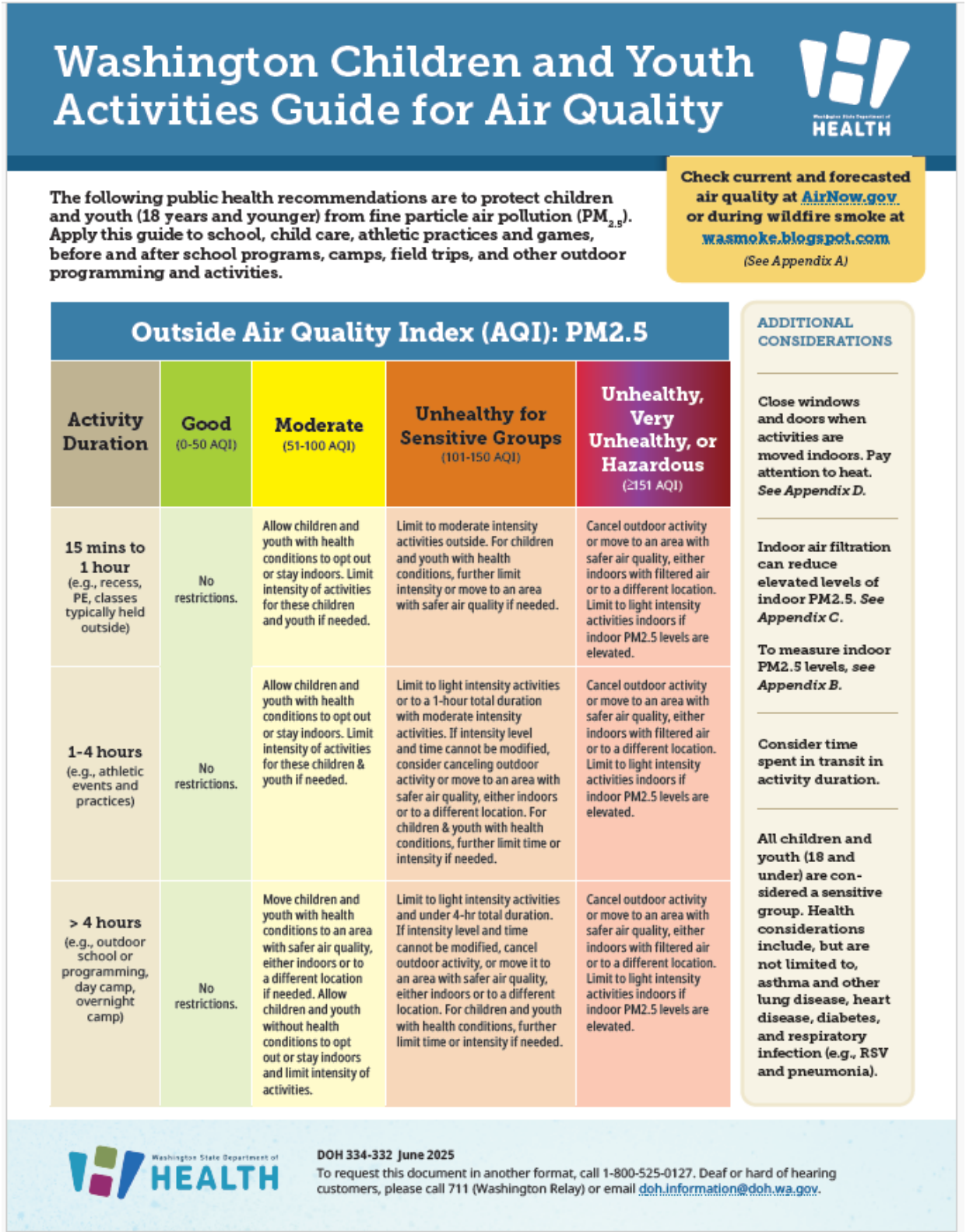


Figure 15. Washington Children and Youth Activities Guide for Air Quality



Washington Children and Youth Activities Guide for Air Quality

Washington State Department of HEALTH

The following public health recommendations are to protect children and youth (18 years and younger) from fine particle air pollution ($PM_{2.5}$). Apply this guide to school, child care, athletic practices and games, before and after school programs, camps, field trips, and other outdoor programming and activities.

Check current and forecasted air quality at AirNow.gov or during wildfire smoke at wasmoke.blogspot.com
(See Appendix A)

Outside Air Quality Index (AQI): PM2.5

Activity Duration	Good (0-50 AQI)	Moderate (51-100 AQI)	Unhealthy for Sensitive Groups (101-150 AQI)	Unhealthy, Very Unhealthy, or Hazardous (≥151 AQI)
15 mins to 1 hour (e.g., recess, PE, classes typically held outside)	No restrictions.	Allow children and youth with health conditions to opt out or stay indoors. Limit intensity of activities for these children and youth if needed.	Limit to moderate intensity activities outside. For children and youth with health conditions, further limit intensity or move to an area with safer air quality if needed.	Cancel outdoor activity or move to an area with safer air quality, either indoors with filtered air or to a different location. Limit to light intensity activities indoors if indoor PM2.5 levels are elevated.
1-4 hours (e.g., athletic events and practices)	No restrictions.	Allow children and youth with health conditions to opt out or stay indoors. Limit intensity of activities for these children & youth if needed.	Limit to light intensity activities or to a 1-hour total duration with moderate intensity activities. If intensity level and time cannot be modified, consider canceling outdoor activity or move to an area with safer air quality, either indoors or to a different location. For children & youth with health conditions, further limit time or intensity if needed.	Cancel outdoor activity or move to an area with safer air quality, either indoors with filtered air or to a different location. Limit to light intensity activities indoors if indoor PM2.5 levels are elevated.
> 4 hours (e.g., outdoor school or programming, day camp, overnight camp)	No restrictions.	Move children and youth with health conditions to an area with safer air quality, either indoors or to a different location if needed. Allow children and youth without health conditions to opt out or stay indoors and limit intensity of activities.	Limit to light intensity activities and under 4-hr total duration. If intensity level and time cannot be modified, cancel outdoor activity, or move it to an area with safer air quality, either indoors or to a different location. For children and youth with health conditions, further limit time or intensity if needed.	Cancel outdoor activity or move to an area with safer air quality, either indoors with filtered air or to a different location. Limit to light intensity activities indoors if indoor PM2.5 levels are elevated.

ADDITIONAL CONSIDERATIONS

Close windows and doors when activities are moved indoors. Pay attention to heat. *See Appendix D.*

Indoor air filtration can reduce elevated levels of indoor PM2.5. *See Appendix C.*

To measure indoor PM2.5 levels, *see Appendix B.*

Consider time spent in transit in activity duration.

All children and youth (18 and under) are considered a sensitive group. Health considerations include, but are not limited to, asthma and other lung disease, heart disease, diabetes, and respiratory infection (e.g., RSV and pneumonia).

Washington State Department of HEALTH

DOH 334-332 June 2025
To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email doh.information@doh.wa.gov.

(Figure 15 continued)

Sources of PM2.5	The primary sources of $PM_{2.5}$ are typically wildfire smoke during warmer months and smoke from home heating during colder months, though this varies by location. Other sources include vehicle exhaust, industrial emissions, and prescribed burning.
Children's Health & Increased Risk	Children and youth are more sensitive to health effects from breathing in $PM_{2.5}$ because they breathe in more air than adults for their body weight. This increases their total dose of air pollution. The respiratory system also develops until about age 21. Children and youth with health conditions (including asthma and other lung diseases, heart disease, and diabetes) have a higher risk of emergency department visits and hospitalizations compared to children without health conditions. Children and youth may also be at risk for declines in academic performance, neurodevelopmental problems, and chronic conditions in adulthood. Children with asthma should follow their Asthma Action Plan.
Symptoms	Symptoms of $PM_{2.5}$ exposure include burning eyes, coughing, throat and nose irritation, fatigue, headache, wheezing, and shortness of breath. Monitor symptoms. If symptoms become serious, seek medical attention. Symptoms can continue or appear in the week following exposure to $PM_{2.5}$.
Physical Activity	CDC recommends children and youth 6-17 years old exercise an hour or more every day as an important part of health. WAC 110-300-0360(2)(c) requires minimum outdoor activity/active play in child care programs with an exception for extreme weather. Safe outdoor play when $PM_{2.5}$ levels are high, especially for days or weeks, requires precautions. People breathe deeper and take more air into their lungs when exercising, thus taking in more air pollution. Children and youth's breathing rates increase over 2 times during light intensity physical activity, over 4 times during moderate intensity activity, and over 8 times during high intensity activity compared to being at rest. Intensity level is related to the exertion and varies individually, but as examples: » Light Intensity Activities: playing board games, playing catch, and stacking blocks » Moderate Intensity Activities: climbing on playground, dodgeball, four-square, golf, gymnastics, hopscotch, lightly riding a tricycle/bicycle, marching band, moderate or brisk walking, shooting basketballs, softball/baseball, table tennis, volleyball, weight training, and yoga » High Intensity Activities: aerobic dance, basketball, cheer, competitive swimming, football, jogging, jumping jacks, jump rope, karate, race walking, running, soccer, swimming, tennis, and vigorous bicycling For a more detailed list see CDC's guidance, "General Physical Activities Defined by Level of Intensity."
Reducing Exposures	As $PM_{2.5}$ pollution increases, each action is increasingly important to protect health: limit duration and intensity of outside physical activity (e.g., increase rest periods), stay indoors when possible and keep indoor air clean. Consider a child's total exposure throughout the day and night, including time spent at school, home, and in transit. Walking, biking, or riding in a bus with windows opened is time outdoors. Some children may not have cleaner air at home.
Masks & Respirators	A NIOSH approved N95 or other particulate respirator can be an option when you have no other way to avoid wildfire smoke. NIOSH approved respirators do not come in suitable sizes for very young children and have not been tested for broad use in children. Effective use requires proper selection, size and fit. See Western States PEHSU guidance (PDF) on respirator use by children. More NIOSH information here.
Air Quality Monitoring & Low-Cost Sensors	**Outdoor Air Monitoring:** Use air pollution forecasts and government agency monitors on AirNow.gov for non-wildfire smoke pollution. Use the Washington Smoke Blog for wildfire smoke. The Smoke Blog includes low-cost sensors and has the most relevant forecasts for Washington wildfire smoke during wildfire season. See Appendix A. **Indoor Air Monitoring:** Indoor low-cost sensors can be used for indoor activities. Do not compare uncorrected sensor data to the AQI. Compare sensor data in locations throughout the facility and indoors vs outdoors. See Appendix B.
Indoor Air Quality	During high levels of $PM_{2.5}$ or extended durations of poor air quality, taking steps to improve indoor air quality is extra important because $PM_{2.5}$ will seep into buildings. If you're not sure whether indoor $PM_{2.5}$ levels are lower than outside, assume levels are similar and increase steps to reduce exposure. Indoor air filtration (HVAC systems with particle filtration of MERV 13 or higher, or HEPA portable air cleaners) can reduce indoor levels of $PM_{2.5}$. Do not use air cleaners that produce ozone or have additive technology, such as ionization and plasma. See Portable Air Cleaners. See Appendix C.
Adult Staff & Volunteers	Adult staff and volunteers can be impacted by air pollution, see WA Air Quality Guide for Particle Pollution. For policies on outdoor workers during wildfire smoke, see WA L&I's Wildfire Smoke Workplace Safety & Health webpage.
School Closures	Consider school and facility closures if you cannot maintain indoor $PM_{2.5}$ below 150.5 µg/m3 (AQI value of 201). See Summary Wildfire Smoke Guidance for Closing Schools (PDF), which includes factors to consider.
Resources	**Websites:** WA DOH's Smoke from Fires and Health, WA DOH's Indoor Air Quality, and EPA's Air Quality Flag Program. For technical assistance: airquality@doh.wa.gov.

Washington Children and Youth Activities Guide for Air Quality
2

(Figure 15 continued)

Appendix A: Outdoor Air Quality Monitoring for Decision Making During Wildfire Smoke Events

Wildfire smoke can fluctuate throughout the day, or it can linger and be stable. It is difficult to predict. This makes it challenging to plan activities in advance. Forecasts and current measurements can inform your decision-making around canceling, modifying, delaying, or ending activities early. For longer duration activities, check measurements throughout the day. When decisions need to be made several hours in advance, it may not reflect conditions at the time of the activity.

The Washington Smoke Blog (https://wasmoke.blogspot.com) is the best source of outdoor air quality information when making decisions about outdoor activities when there is wildfire smoke. Use a combination of forecasts and current measurements from agency monitors and/or outdoor low-cost air sensors, as described below. Your regional clean air agency may have additional information for your area.

For activities planned in advance, use forecasts for your area or in the area the activity is occurring. Forecasts up to 5 days in advance, including the current day, are available on the WA Smoke Blog map by regions during wildfire season. The forecasts for the first 2 days are more accurate than for days 3-5. Written blog posts and comments often include additional forecast information. Keep in mind that forecasts are for daily (24-hr) conditions, and the real-time conditions may be better or worse due to fluctuations throughout the day.

In the hours leading up to the activity (or throughout the day for long duration activities, such as summer camp), track the current measurements as described below.

Important: *Low-cost sensor measurements on their own can be very inaccurate during wildfire smoke events. It is important to follow the steps below to view low-cost sensor data on public agency websites, where it has been corrected for wildfire smoke. We do not recommend using private or third-party websites (including third-party weather apps) where the data may not have been verified and adjusted.*

To view current outdoor air quality data near you:

Step 1:

Use the Fire and Smoke Map on the WA Smoke Blog (https://wasmoke.blogspot.com) or on the "Smoke" tab of the AirNow app.

Step 2:

Find the agency $PM_{2.5}$ monitor (larger circles, or medium-size circles labeled with a "T" on the map) and/or low-cost $PM_{2.5}$ sensor (smaller circles on the map)") closest to your event. Low-cost $PM_{2.5}$ sensors are commercially available devices that can be operated by anyone. Low-cost sensors are generally less accurate than the agency monitors, and since many are operated by members of the public, their performance, siting, and maintenance are unknown. One exception is the SensWA sensors, which are low-cost sensors operated by Ecology. The data from SensWA sensors is generally more reliable than other low-cost sensors. Low-cost sensor data can be inaccurate, but on the WA Smoke Blog and Fire and Smoke Map, sensor data are adjusted for wildfire smoke.

The monitor and sensor data you view on the map will be more or less similar to your actual location based on how far away the monitor/sensor is from your location and other factors. Consider differences in elevation, terrain, wind direction, and weather between your location and the monitor/sensor location. For example, a nearby monitor/sensor in a location with similar elevation and weather and is not separated from your location by a ridge, will probably provide

(Figure 15 continued)

Appendix A: Outdoor Air Quality Monitoring for Decision Making During Wildfire Smoke Events *contd.*

better information for your location than a monitor/sensor that is on the other side of a ridge or at a different elevation, like in a valley. You might find that you need a sensor at your specific location. As of 2025, outdoor Purple Air and Clarity sensors are displayed on the EPA Fire and Smoke map.

Remember to also consider the air quality along routes of transit that people will be exposed to when they travel to and from your event.

The markers on the map show the color of the NowCast Air Quality Index (AQI) hazard level, which is approximately based on the conditions over the past few hours and is updated hourly. For tracking data over the last 30 minutes, see steps 3 and 4.

Click or tap on the monitor (larger circle) or low-cost sensor marker (smaller circle) closest to your event

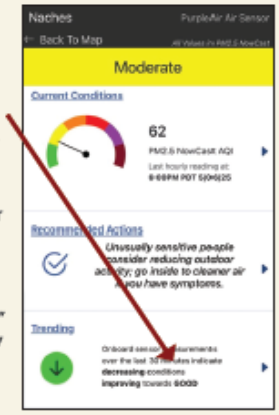
(Screenshots are from the "Smoke" tab of the AirNow phone app, May 2025.)

To view the NowCast AQI number, click or tap on the monitor or sensor marker. A new window should pop up, showing you the NowCast AQI number and category, as well as a trend (air quality is getting better, getting worse, or staying the same). Click or tap on the "trend" icon to see more information about the trend.

In addition to using a forecast and NowCast AQI for planning purposes, use the trend information to make a decision about activities happening within about an hour. This is especially important if the current conditions are changing quickly or seem different from the forecast or the NowCast AQI. The trend shows how recent values compare to the NowCast. If the recent values are higher, then the trend is increasing (worsening air quality). If the recent values are lower, the trend is decreasing (improving air quality). The AQI Trend category is what was observed in the past 30 minutes for sensors and monitors with sensors nearby, or from the last hourly concentration for monitors without sensors nearby.

Use this AQI category to decide about activities happening within about the next hour. If more than one category is displayed, use the higher (worse) category.

(Screenshots are from the "Smoke" tab of the AirNow phone app, May 2025.)



In Step 2 (above): Click or tap on the "trend" icon. This will take you to a more detailed view, as shown to the left.

Step 3:

Use this AQI category to decide about activities happening within about the next hour. If more than one category is displayed, use the higher (worse) category.

Step 4:

Repeat step 3 every 30 minutes, or sooner if it appears that conditions are changing rapidly and change your activity decisions accordingly.

(Figure 15 continued)

Appendix A: Outdoor Air Quality Monitoring for Decision Making During Wildfire Smoke Events *contd.*

Example scenario 1:

You are deciding whether to have outdoor recess, and you do not need to make this decision in advance. Earlier in the morning, the NowCast AQI category was "Unhealthy." Now it is time for recess and the current Trending AQI category is "Moderate." Based on the Trending AQI category of "Moderate" you decide to have outdoor recess but allow children and youth with health conditions to opt out or stay indoors.

Example scenario 2:

You are deciding whether to hold an athletic event and this decision must be made several hours in advance due to the logistics involved. The forecast for the day is "Unhealthy for Sensitive Groups" but the NowCast is "Unhealthy." You decide to follow the guidance for the "Unhealthy" category. This is a challenging decision because the air quality conditions could change by the time of the event, but because you need to plan several hours in advance, you decide to cancel using the best information that you have.

Alternatively, you decide to move forward with planning the activity with the understanding that it may not be possible. You check the Trending AQI category at the start time of the activity and decide based on that AQI category. If you decide to start the event, you continue checking the Trending AQI category every 30 minutes to see if the AQI category worsens and the event needs to end early.

Example scenario 3:

You are planning a day of summer camp. Based on the forecast of "Good" the day before, you had planned a day of high intensity activity. Prior to starting the activity, you check the Trending AQI category, and it is "Moderate." Therefore, you come up with an alternate activity indoors for children and youth with health conditions, and those without health conditions who wish to opt out of the high intensity activity. You continue checking the Trending AQI category every 30 minutes to see if the high intensity activity needs to be modified later in the day.

Why does my sensor/commercial weather app/sensor map display different AQI numbers or colors from what I see on the Washington Smoke Blog, Fire and Smoke map, or AirNow?

- Sensors use a variety of averaging times to display the AQI, for example the Purple Air map default is to show the AQI level from the last 10 minutes. The numbers on government sites, such as AirNow and the Fire and Smoke Map, use a NowCast averaging time of 3-12 hours. If the air quality is changing rapidly, the two numbers could be very different.
- Even when a correction factor is applied to sensors (for example, Purple Air data on the Fire and Smoke Map), sensors are less accurate than government air quality monitors.
- A commercial site or device may use a different color scheme or AQI category cut-off than the official AQI.
- Sometimes the air quality is different even over a short distance. If your closest agency monitor is not very close, your local air quality measured by a nearby sensor may be different than the air quality around the agency monitor.

(Figure 15 continued)

Appendix B: Indoor Air Quality Monitoring

A portable handheld sensor can show how indoor $PM_{2.5}$ levels vary throughout a facility. A stationary indoor sensor can track changes in indoor air quality over longer periods. See Wildfire Smoke Guidance for Canceling Events or Activities and Closing Schools section "Indoor $PM_{2.5}$ Measurement in Schools" for more information about using indoor sensor data for decisions that need to be made in advance. Use the information below for immediate decision-making.

If you don't have an indoor air sensor:
If you're not sure whether indoor $PM_{2.5}$ levels are lower than outside, assume levels are similar and increase steps to reduce exposure, including filtration methods. Using a low-cost sensor can give you a better idea of your indoor $PM_{2.5}$ levels. If you're considering purchasing a low-cost $PM_{2.5}$ sensor, check the performance evaluations developed by the South Coast AQMD. A Field R-squared value near 1 and a relatively low Field MAE indicate a better-performing sensor.

If you do have an indoor air sensor and/or a portable handheld sensor:
Low-cost sensors can be used to take $PM_{2.5}$ measurements to check indoor air quality. They are generally less accurate than agency air monitors, though correction factors can be applied to reduce bias. Sensor measurements can vary in three important ways: whether correction factors are applied (for example, a Purple Air that is used indoors with the US EPA correction factor applied), the time interval used for data averaging, and whether the sensor displays the AQI or the $PM_{2.5}$ concentration in µg/m3 units. To the extent possible, only compare data that is similar in these three ways (e.g., do not compare uncorrected sensor data to corrected sensor data or AQI breakpoints; do not compare real-time sensor data to longer-term averages). EPA provides a calculator to convert between $PM_{2.5}$ concentrations and AQI values: https://www.airnow.gov/aqi/aqi-calculator.

If indoor sensor shows...	...then...
Corrected real-time or 10-minute PM2.5 concentrations in µg/m3	» Compare sensor data to 10-minute or 1-hour data from Washington Smoke Blog or Fire and Smoke Map (see screenshots below). » Prior to each decision-point (e.g., before starting indoor recess or indoor PE class), check that the indoor real-time or 10-minute PM2.5 concentration is not elevated when deciding about activity intensity. During smoke periods, the threshold of 35.5 µg/m3 is a useful target of indoor concentration (the lower the better). Check sensor measurements again every 30 minutes and change activity decisions accordingly.
Uncorrected real-time or 10-minute PM2.5 concentrations in µg/m3	» No direct comparison to the AQI or a specific target concentration is possible. » Instead, compare indoor and outdoor sensor measurements to each other to estimate indoor concentrations. For example, if the indoor PM2.5 sensor measurements are half of the outdoor PM2.5 sensor measurements, assume that the indoor PM2.5 concentrations are half what is reported by the nearest 10-minute or 1-hour data from Washington Smoke Blog or Fire and Smoke Map (see screenshots below). » Example: outdoor sensor measurement = 100 µg/m3 and indoor sensor measurement = 50 µg/m3, so indoor is half of outdoors. • Washington Smoke Blog measurement = 76 µg/m3 → new indoor concentration estimate is half of 76, which is 38 µg/m3. • Use this new indoor concentration estimate: Prior to each decision-point (e.g., before starting indoor recess or indoor PE class), check that the indoor real-time or 10-minute PM2.5 concentration is not elevated when deciding about activity intensity. During smoke periods the threshold of 35.5 µg/m3 is a useful target of indoor concentration (the lower the better). Check sensor measurements again every 30 minutes and change activity decisions accordingly.

(Figure 15 continued)

Appendix B: Indoor Air Quality Monitoring *contd.*

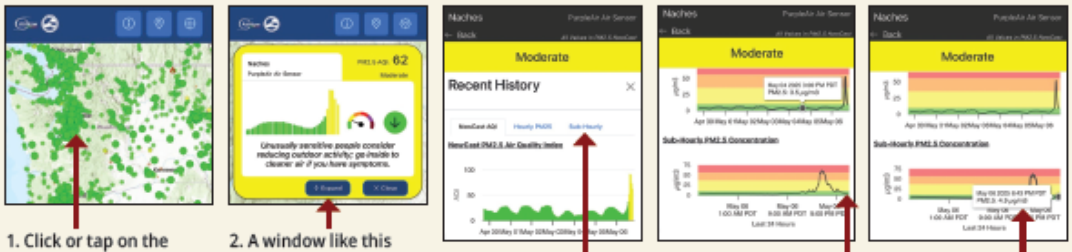
When indoor $PM_{2.5}$ concentrations are higher than outdoor, opening windows can help clear out indoor $PM_{2.5}$. When outdoor $PM_{2.5}$ concentrations are higher than indoor, closing windows can help keep $PM_{2.5}$ out. At the same time, pay attention to the indoor and outdoor temperatures when opening or closing windows to keep it from becoming too hot or cold indoors (See Appendix D). When opening windows, continue checking sensor measurements every 30 minutes.

If you have a portable handheld sensor:

When outside $PM_{2.5}$ levels reach "Unhealthy for Sensitive Groups," assess variation across the building(s)

- Include measurements in rooms used by children and youth that are expected to have worse ventilation or indoor air quality (like no air filtration), rooms where physical activity is usually more vigorous (like the gym), rooms with external doors opened frequently, any external buildings (like portables), and rooms with children who may be more sensitive to air pollution.
- Wait for sensor measurements to stabilize in each room (about 1-2 minutes for measurements that appear to change in real-time on a screen).
- Repeat the portable sensor measurements in different conditions, such as changes in occupancy, and repeat prior to each decision-point.
- If you have more than one option for where to hold indoor recess, use a portable sensor to choose the location with lower $PM_{2.5}$.
- Prioritize steps to reduce exposure in the rooms with highest $PM_{2.5}$ levels.

How to get 10-minute (corrected sensor data) or hourly (agency monitor) $PM_{2.5}$ concentrations from the Washington Smoke Blog or Fire and Smoke Map:



1. Click or tap on the monitor (larger circle) or low-cost sensor (smaller circle) closest to you

(Screenshots are from the "Smoke" tab of the AirNow phone app, May 2025.)

2. A window like this should pop up. Click or tap on "Expand."

   Scroll down within the pop-up window to get to "Recent History". Click or tap on "Recent History."

3. Select the "Sub-Hourly" tab if available, otherwise select "Hourly PM25"

4. Tap, click, or hover on the end of the graph

5. This number is **NOT THE AQI.** This is the PM2.5 measurement. Note that the time of the most recent measurement may lag behind.

Indoor air pollution is made up of outdoor air pollution that comes inside, and pollution that comes from indoor sources. Consider monitoring for air pollutants besides $PM_{2.5}$, such as carbon monoxide (CO) and carbon dioxide (CO2).

(Figure 15 continued)

Appendix C: Improving Indoor Air Quality

During outside air pollution events, reducing additional air pollution as much as possible to reduce exposures is especially important. To help reduce exposure, limit both outdoor activities, like vehicle idling, other vehicle emissions, and outdoor burning, as well as indoor activities, like frying without kitchen exhaust, smoking or vaping, using household chemicals, vacuuming without a HEPA filter, or burning candles.

Outside $PM_{2.5}$ gets indoors through windows, doors, small openings, and some ventilation systems. Buildings with well-maintained and enhanced filtration (i.e., MERV 13 or higher) on ventilation system air intakes have improved indoor air quality and should run the HVAC fan continuously. Supplementing with HEPA portable air cleaners or DIY box fan filters can reduce PM2.5 in single rooms. Use HEPA portable air cleaners that have a smoke Clean Air Delivery Rate (CADR) equal to at least 2/3 the room square footage (an AHAM Verifide smoke CADR is best), and uses HEPA and carbon filtration only (look for models listed as "mechanical" on the CARB-Certified air cleaner list). Do not use ozone generators, ionizers, UV or other additive technologies in air cleaners because these technologies can add harmful pollutants to indoor air. See Portable Air Cleaners for more information. For additional information, see Improving IAQ and Ventilation in Schools During Wildfire Smoke Events and ASHRAE Protecting Building Occupants from Smoke.

Extreme heat can overlap with wildfire season. Have plans for keeping buildings cooler to avoid the need to open windows during wildfire smoke if there is no air conditioning. See Cooling Indoor Spaces Without AC.

If wildfire smoke events are occurring at the same time as transmission of respiratory viruses, such as COVID-19 or other respiratory infections, it is important to balance the risk of both hazards when bringing children and youth inside to reduce exposure to smoke. Indoor air filtration mitigates the risk of both smoke and respiratory viruses. To bring in outdoor air, track the air quality and open windows and doors a few times a day when outdoor $PM_{2.5}$ is in the Good AQI category or better than indoors. Close them if outdoor $PM_{2.5}$ levels are elevated (Moderate or worse AQI category) or worse than indoors. You can find outdoor air quality information at AirNow.gov or during wildfire smoke events at the Washington Smoke Blog. For more information, see WA DOH's Recommendations for wildfire smoke and COVID-19 (PDF).

(Figure 15 continued)

Appendix D: Considerations for when Heat and Poor Air Quality Overlap

Heat affects everyone differently. Some individuals may be more susceptible to heat-related illness due to factors such as their environment, level of activity, age, access to financial resources, or underlying health conditions – including the use of some medications that may reduce the body's ability to regulate temperature. Children are especially vulnerable to heat-related illness because they are often active and their bodies are still developing.

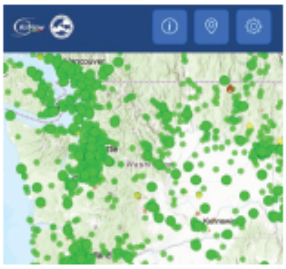
When someone is exposed to both extreme heat and poor air quality at the same time, the health impacts can be more severe than they would be separately. It is important to track conditions and forecasts of both air quality and heat.

The National Weather Service HeatRisk forecast provides a quick view of the risk posed by heat for the next seven days. HeatRisk is portrayed in a numeric (0 – 4) and color (green, yellow, orange, red, or magenta) scale, which is similar in approach to the Air Quality Index (AQI). HeatRisk provides one value each day for a location that indicates the approximate level of heat risk concern, along with identifying groups who are most at risk.

It can be a challenge to keep smoke from coming indoors when it's hot, especially without air conditioning, when windows are used for cooling. Pay attention to rising temperatures, as heat-related illnesses can occur quickly and can be life threatening. Rooms used by students or staff must be kept reasonably free of "excessive heat" (Chapter 246-366 WAC). School learning spaces should be no hotter than 79 °F (see guidance from U.S. EPA, following ASHRAE Standard 55, with some differences by season and humidity).

If it's hot indoors during poor air quality, use these steps to help stay cool and safe:

- Close windows and curtains or shades during the day. Use portable fans (be aware that fans are not effective for cooling when the temperature is above 95 degrees).
- Turn off sources of heat, such as kilns, ovens, and electronics.
- Stay hydrated, especially with water. Avoid sugary drinks since these can be dehydrating.
- Teach staff to recognize and prevent heat- and smoke-related illnesses.
- Track the air quality (See Appendix A) and monitor indoor temperatures. Ideally, only open windows when the outdoor air quality improves and it is cooler outside than inside. However, opening windows during poor outdoor air quality may be necessary to maintain safe temperatures indoors. Open an additional door or window to be most effective and provide a cross draft. Keep safety protocols in mind when opening doors and windows. If possible, relocate to a cooler indoor space and take steps to filter indoor air (See Appendix C).



- Limit, modify, or move strenuous indoor and outdoor activities. If relocating indoors, go to a place that is cooler and has cleaner air. When student-occupied indoor areas are excessively hot or are smoky, discuss partial or full school facility closures with administrators and local health jurisdictions. For smoke, see Summary Wildfire Smoke Guidance for Closing Schools.
- For updated information on cooling centers in your community, visit Washington 2-1-1. Provide cooling center and cleaner air center information to families.

(Figure 15 continued)

Appendix D: Considerations for when Heat and Poor Air Quality Overlap *contd.*

Consider whether to cancel, move, or reschedule outdoor activities and indoor activities taking place in uncooled locations without air filtration. This is especially important for activities taking place during the hottest period of the day. If possible, shift the times for activities to times of day that are cooler and have better air quality. However, sometimes the coolest part of the day can also be the smokiest. Also see the Washington Interscholastic Activities Association's Heat Index Policy.

For more information, see:

Cooling Indoor Spaces Without Air Conditioning (PDF)

DOH's hot weather safety guidance

About Heat and Your Health | Heat Health | CDC

CDPH Extreme Heat Guidance for Schools

Tips and Action Plans for Children and Teens with Asthma | Heat Health | CDC

Heat and Athletes | Heat Health | CDC

HeatRisk v2.6 - Understanding HeatRisk

For adult staff and volunteers: WA L&I's Outdoor Heat Exposure Rules for outdoor workers.

Washington State Department of HEALTH

DOH 334-332 June 2025

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Acknowledgements

Key adjustments to reflect changes to the Air Quality Index and other updates were made in 2024 led by Annie Doubleday (WA State Department of Health (DOH)) and Jill Schulte (WA State Department of Ecology (ECY)). Julie Fox, Kaitlyn Kelly, and Orly Stampfer of DOH made significant contributions to the 2022 updates. This document was first developed in collaboration with the Closures Workgroup of the Wildfire Smoke Impacts Advisory Group, led by Julie Fox, with air monitoring expertise from Jill Schulte. This is an interagency group of local, state, and federal partners, and academic partners, who are professionals in air quality and public health practice. The original Closures Workgroup members include the following*:

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