1. **Stay informed about air quality**
   - Check the air quality hazard level

2. **Limit exposure**
   - Avoid strenuous outdoor activity
   - Limit time outdoors
   - Stay indoors

3. **Keep indoor air clean**
   - Keep windows and doors closed
   - Don’t contribute to poor air quality
   - Set AC on recirculate
   - Use an air cleaner with a HEPA filter

4. **Pay attention to symptoms**
   - Seek medical help if needed
Wildfire Smoke Impacts Advisory Group

27 Members
Including Washington State Department of Health, local health jurisdictions, tribal communities, Department of Ecology, Labor & Industries, regional clean air authorities, University of Washington

3 Sub Workgroups to address 3 Priorities for the 2019 Wildfire Season

<table>
<thead>
<tr>
<th>Communication Workgroup</th>
<th>Closures Workgroup</th>
<th>Sensors Workgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop custom toolkit for local outreach and communication</td>
<td>Develop guidance for school and outdoor event closures</td>
<td>Develop guidance for low-cost sensors to use for health decisions</td>
</tr>
</tbody>
</table>
Wildfire Smoke Impacts Advisory Group

27 Members
Including Washington State Department of Health, local health jurisdictions, tribal communities, Department of Ecology, Labor & Industries, regional clean air authorities, University of Washington

3 Sub Workgroups to address 3 Priorities for the 2019 Wildfire Season

- **Communication Workgroup**: Develop custom toolkit for local outreach and communication
- **Closures Workgroup**: Develop guidance for school and outdoor event closures
- **Sensors Workgroup**: Develop guidance for low-cost sensors to use for health decisions
Wildfire Smoke Response Toolkit

- Created catalogue of available resources for key messages for each audience and timing

Example from catalogue:

<table>
<thead>
<tr>
<th>Audience</th>
<th>Key Messages</th>
<th>Appropriate Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>School K-12 (includes principles,</td>
<td>• Track air quality and utilize your resources</td>
<td>4, 15, 28, 59, 68, 73</td>
</tr>
<tr>
<td>superintendents, administrative</td>
<td>• Follow alternative plan for recess/outdoor school activities to smoke</td>
<td></td>
</tr>
<tr>
<td>staff)</td>
<td>exposure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Communicate and coordinate with local health jurisdiction and air quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>authority</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Follow closure recommendations when conditions are met</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Takes steps to improve indoor air quality</td>
<td></td>
</tr>
</tbody>
</table>

- Identified gaps and topics with inconsistent messages
- Developed resources to fill gaps
- Created templates for communications mediums for local use
- Distribution in progress
Target Audiences

General public
Healthcare providers
Facility managers for outdoor camps and athletic activities
School K-12 principals, superintendents & administrative staff
School nurses & school health team
Child care providers
Long-term care and assisted living facilities
Planners of public events
Templates for local use

• Letters to target audiences
• News releases
**Wildfire Smoke Impacts Advisory Group**

**27 Members**
Including Washington State Department of Health, local health jurisdictions, tribal communities, Department of Ecology, Labor & Industries, regional clean air authorities, University of Washington

**3 Sub Workgroups** to address **3 Priorities** for the **2019 Wildfire Season**

<table>
<thead>
<tr>
<th><strong>Communication Workgroup</strong></th>
<th><strong>Closures Workgroup</strong></th>
<th><strong>Sensors Workgroup</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop custom toolkit for local outreach and communication</td>
<td>Develop guidance for school and outdoor event closures</td>
<td>Develop guidance for low-cost sensors to use for health decisions</td>
</tr>
</tbody>
</table>
Draft Wildfire Smoke Closures Guidance

Guidance on Canceling Events or Activities and Closing Schools During Wildfire Smoke Episodes

During wildfires with elevated smoke levels, the Department of Health and Ecology have been asked for guidance about the level of indoor smoke that should lead to consideration of closing schools and other facilities, and/or making plans for relocation of populations to cleaner indoor areas. The Department of Health and Ecology do not have authority to make decisions about closures, relocations, or evacuations, but these decisions are made at the local level. This document is intended to provide guidance about air concentrations of smoke that are considered a health concern.

Health Concern & steps to reduce exposures

Exposure to wild fire smoke, like all smoke, can cause health problems. Long-term effects of smoke exposure include minor irritation such as burning eyes, runny nose and coughing. There are also more serious effects, such as aggravation of existing heart and lung disease, may be life threatening, including triggering asthma attacks and flare-ups of COPD, producing abnormal heart rhythms, heart attack and stroke.

When smoke levels are elevated, sensitive populations are specially at-risk for experiencing adverse health effects. Sensitive populations include people with heart or lung disease, people with respiratory infections, people with diabetes, elderly people, children, pregnant women, and young children.

Most epidemiologic research of wild fire smoke and acute health effects that occur within a week or less of elevated 24-hour PM2.5 exposure. Several studies have evaluated long-term health impacts on the order of about one week to several weeks of short-term exposure, with most acute effects occurring within 2 to 4 days of exposure. There is not much data about the impacts of wild fire smoke beyond about a week of exposure in normal research about long-term health impacts resulting from wildfires (Seguin et al., 2013). Though there is evidence that people recover from exposure to smoke within weeks. Studies of wild fire smoke have found that forcing respiratory capacity in one session (FWP) declines over a firefighting season, and results to baseline within months (Nielson et al., 2012). Particulate clearance from lungs of healthy people is nearly complete after several days, but clearance takes longer in people with progressive lung diseases (Lippmann et al., 1980; Wagner et al., 1989). Particle clearance rates are relatively long in comparison to most chronic non-smoker wild fire smoke episodes. This suggests most people will likely recover within a few weeks after initiation of wild fire smoke. However, there may be some residual physical damage.

Recommended PM2.5 Action Level for Closures and Cancelations

For outdoor events, the Department of Health recommends that when outdoor PM2.5 concentrations exceed 25.5 μg/m³ (AQI value of 101), public health officers should consider cancelling outdoor public events. When outdoor PM2.5 concentrations exceed 50.5 μg/m³ (AQI value of 164), outdoor events should be cancelled.

For school relocations, the Department of Health recommends that local administrators consider school closures when air monitoring identifies that indoor PM2.5 concentrations exceed 50.5 μg/m³.

Factors to consider in closures and cancelations

- Measurement of PM2.5
- Estimated risk (TBD)
- Action level
Factors to consider for cancelations

Examples for outdoor events & activities:

• What is the forecast for how long the wildfire smoke levels will remain high?
• Is there an option to relocate to an area with cleaner air?
• Is the visibility safe for driving?
Recommended measurement of PM$_{2.5}$

- For outdoor events & activities: *outdoor* PM2.5 concentrations
- For schools: *indoor* PM2.5 concentrations

PM2.5 Concentrations:

- **20 µg/m$^3$**
  - PM$_{2.5} = 20$ µg/m$^3$, RH = 40%, $B_{ext} = 74$ Mm$^{-1}$, Visual Range = 33 miles, Deciview = 20

- **35 µg/m$^3$**
  - PM$_{2.5} = 35$ µg/m$^3$, RH = 40%, $B_{ext} = 122$ Mm$^{-1}$, Visual Range = 20 miles, Deciview = 25

- **150 µg/m$^3$**
  - PM$_{2.5} = 150$ µg/m$^3$, RH = 40%, $B_{ext} = 491$ Mm$^{-1}$, Visual Range = 5 miles, Deciview = 38.4

Photos of Denver, CO: Poirot, R. AWMA EM 2011 (Sept) 10-15
Preliminary estimates of excess hospitalizations attributed to wildfire smoke

What is an acceptable level of risk?

Risk Estimate Data Sources
Washington Air Quality Advisory (WAQA) vs. EPA’s Air Quality Index (AQI)

WAQA designed to be more health protective
# DOH Air Pollution and School Activities Guide

## Air Quality Conditions*

First, check local air conditions at [https://fortress.wa.gov/ecy/enviwa/](https://fortress.wa.gov/ecy/enviwa/) and then use this chart.

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Moderate</th>
<th>Unhealthy for Sensitive Groups</th>
<th>Unhealthy</th>
<th>Very Unhealthy/Hazardous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recess</strong> (15 minutes)</td>
<td>No restrictions.</td>
<td>Allow students with asthma, respiratory infection, lung or heart disease to stay indoors.</td>
<td>Keep students with asthma, respiratory infection, and lung or heart disease indoors.</td>
<td>Keep all students indoors and keep activity levels light.</td>
<td>Keep all students indoors and keep activity levels light.</td>
</tr>
<tr>
<td><strong>P.E.</strong> (1 hour)</td>
<td>No restrictions.</td>
<td>Monitor students with asthma, respiratory infection, lung or heart disease. Increase rest periods or substitutions for these students as needed.</td>
<td>Keep students with asthma, respiratory infection, lung or heart disease, and diabetes indoors. Limit these students to moderate activities. For others, limit to light outdoor activities. Allow any student to stay indoors if they don't want to go outside.</td>
<td>Conduct P.E. indoors. Limit students to light indoor activities.</td>
<td>Keep all students indoors and keep activity levels light.</td>
</tr>
<tr>
<td><strong>Athletic Events and Practices</strong> (Vigorous activity 2-3 hours)</td>
<td>No restrictions.</td>
<td>Monitor students with asthma, respiratory infection, lung or heart disease. Increase rest periods and substitutions for these students as needed.</td>
<td>Students with asthma, respiratory infection, lung and heart disease, or conditions like diabetes shouldn't play outdoors. Consider moving events indoors. If events are not cancelled, increase rest periods and substitutions to allow for lower breathing rates.</td>
<td>Cancel events. Or move events to an area with “Good” air quality — if this can be done without too much time spent in transit through areas with poor air quality.</td>
<td>Cancel events. Or move events to an area with “Good” air quality — if this can be done without too much time spent in transit through areas with poor air quality.</td>
</tr>
</tbody>
</table>

Source: WA Dept of Health; [www.doh.wa.gov/Portals/1/Documents/Pubs/334-332.pdf](http://www.doh.wa.gov/Portals/1/Documents/Pubs/334-332.pdf)
DOH Air Pollution and School Activities Guide

**WAQA “Unhealthy” Category (>35.4 µg/m³):**
Cancel or move children’s athletic events and practices to an area with good air quality

---

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Moderate</th>
<th>Unhealthy for Sensitive Groups</th>
<th>Unhealthy</th>
<th>Very Unhealthy/ Hazardous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recess (15 minutes)</strong></td>
<td>No restrictions.</td>
<td>Allow students with asthma,</td>
<td>Keep students with asthma,</td>
<td>Keep all students indoors and keep activity levels light.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>respiratory infection, lung or</td>
<td>respiratory infection, and lung or heart disease indoors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>heart disease to stay indoors.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P.E. (1 hour)</strong></td>
<td>No restrictions.</td>
<td>Monitor students with asthma,</td>
<td>Keep students with asthma,</td>
<td>Conduct P.E. indoors. Limit students to light indoor activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>respiratory infection, lung or</td>
<td>respiratory infection, and lung or heart disease, and diabetes indoors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>heart disease, increase rest</td>
<td>Limit these students to moderate activities. For others, limit to light outdoor activities. Allow any student to stay indoors if they don’t want to go outside.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>periods or substitutions for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>these students as needed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Athletic Events and Practices</strong></td>
<td>No restrictions.</td>
<td>Monitor students with asthma,</td>
<td>Students with asthma, respiratory infection, lung and heart disease, or conditions like diabetes shouldn’t play outdoors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Vigorous activity 2-3 hours)</td>
<td></td>
<td>respiratory infection, lung or</td>
<td>Consider moving events indoors. If events are not cancelled, increase rest periods and substitutions to allow for lower breathing rate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>heart disease, increase rest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>periods and substitutions for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>these students as needed.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Source: WA Dept of Health; [www.doh.wa.gov/Portals/1/Documents/Pubs/334-332.pdf](http://www.doh.wa.gov/Portals/1/Documents/Pubs/334-332.pdf)
Existing wildfire smoke response guidance

**US EPA & Other Agencies:**


**Washington State:**

Discussion of closures action levels

WA Comprehensive Emergency Management Plan with WAQA (similar language in Wildfire Smoke Guide with AQI)
- Cancel outdoor public events.
- If school is in session, discuss school closure with school administrators.

<table>
<thead>
<tr>
<th>WAQA PM2.5 Concentration* (µg/m³)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Unhealthy</td>
<td>80.5</td>
</tr>
<tr>
<td>Hazardous</td>
<td>150.5</td>
</tr>
</tbody>
</table>

*Lower break-point of hazard category.
Balance in Public Policy

Wildfire Smoke Impacts Advisory Group

27 Members
Including Washington State Department of Health, local health jurisdictions, tribal communities, Department of Ecology, Labor & Industries, regional clean air authorities, University of Washington

3 Sub Workgroups to address 3 Priorities for the 2019 Wildfire Season

<table>
<thead>
<tr>
<th>Communication Workgroup</th>
<th>Closures Workgroup</th>
<th>Sensors Workgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop custom toolkit for local outreach and communication</td>
<td>Develop guidance for school and outdoor event closures</td>
<td>Develop guidance for low-cost sensors to use for health decisions</td>
</tr>
</tbody>
</table>
Develop Air Measurement & Sensors Guidance Document

Build on existing resources

- EPA & South Coast AQMD

Assessment: Learn from those already using low cost sensors to manage health risks

- Best practices
- Research and validation work
- User-friendliness

https://www.epa.gov/air-sensor-toolbox
http://www.aqmd.gov/aq-spec
Challenging Topics: Request for Research and Input
How do we balance the risk of heat impacts with the risk of smoke inhalation?

- Go indoors and close windows and doors
- Majority in Washington do not have air conditioners
  - Rely on open windows at night for cooling
- Current messages
  - “Be mindful of the heat”
  - “Use your judgement”
  - “Consider leaving the area or going somewhere else with AC”
How should guidance change when smoke events are LONG?

- If there is no active effort to reduce indoor PM with a portable air cleaner or filter in-line with HVAC, how long will PM$_{2.5}$ levels indoors typically stay less than outdoors in real-world homes?
  - Without an air cleaner, is there any benefit to staying indoors over a long period?
- Would it be reasonable to suggest individuals purchase their own low-cost sensors to track home indoor air quality?
- How do we address mental health issues?
With long smoke events, what is the impact of lost physical activity vs. avoided smoke exposure?

Enjoy the outdoors

People with health conditions limit time outdoors and strenuous outdoor activity

All sensitive groups limit time outdoors strenuous outdoor activity

Everyone limit time outdoors and strenuous outdoor activity, choose light indoor activity

Everyone stay indoors and avoid all strenuous activity

Everyone stay indoors and avoid all strenuous activity

---

**Enjoy the outdoors**

<table>
<thead>
<tr>
<th>Washington State in 2016*</th>
<th>Adults</th>
<th>10th Graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met national recommendations for aerobic activity</td>
<td>58%**</td>
<td>24%</td>
</tr>
</tbody>
</table>

**Source: WA State Health Assessment 2018.**
Growing list of questions and concerns

• How effective is closing schools and cancelling outdoor events & activities in reducing risk?

• Are there safety issues with DIY box fans with air filters attached?

• What do we recommend for homeless populations?

• Is there a real risk to children wearing N95 face masks (if they fit)?

• Does wearing a face mask increase risk for people with cardiopulmonary diseases?

• Is our risk communication improving public health?
Thank you!

Julie Fox
Ambient Air Epidemiologist
Office of Environmental Public Health Sciences
julie.fox@doh.wa.gov

Smoke from Fires Website:
www.doh.wa.gov/smokefromfires
Extra Slides
Minor to deadly responses

- Eye irritation
- Cough, wheeze
- Cardiovascular morbidities
- Respiratory morbidities
- Overall increased hospitalizations & deaths
Fewer people suffer the most severe impacts

- Subclinical Effects with No Symptoms
- Respiratory, Cardiovascular, Other Symptoms and/or Medication Use
- ED, Urgent Care, Physician Visits and/or Restricted Activity
- Hospitalizations
- Deaths

Size of Population Exposed to Wildfire Smoke

Figure Adapted from: Cascio et al. Sci total Env. 624: 2018
Groups sensitive to smoke from fires

- People with Pre-Existing Diseases
  - Especially lung and heart diseases
- People with respiratory infections
- Children & Infants
- People 65 years and older
- Pregnant women & fetus

Growing evidence for other sensitive groups

Washington Air Quality Advisory: English / Spanish / Arabic / Chinese / Korean / Punjabi / Russian / Somali / Tagalog / Ukrainian / Vietnamese