Health Effects of Wildfire Smoke

HEAC Meeting
June 5, 2018
Outline

• Health Effects of Particulate Air Pollution
• Ambient Air Quality Standards
• Wildfire Smoke Guidance
• Wildfire-related Research in California
Health Effects of PM2.5 Exposure

• Premature death
  • Causal for cardiopulmonary disease (US EPA)
• Hospital admissions for worsening of respiratory and cardiac disease
• Emergency room visits for asthma
• Reduced lung function in children
  • Increased risk of bronchitis and chronic cough
• Exposure during pregnancy – low birth weight, premature birth, and birth defects
Populations Most at Risk: PM2.5

• Older adults
• People with chronic heart or lung disease
• Children

• Estimated annual health impacts in California
• 7,200 premature deaths
• 1,900 hospitalizations
• 5,200 ER visits for asthma
Ambient Air Quality Standards (AAQS)

• Clean Air Act requires the US EPA to set NAAQS "with an adequate margin of safety...to protect human health”
  • Also mandated in California (CAAQS)

• NAAQS and CAAQS based only on health considerations
  • Zero risk not required
  • Penalties for failure to attain NAAQS by target date
## Current Standards: CAAQS and NAAQS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>NAAQS</th>
<th>CAAQS</th>
<th>Averaging Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM2.5</td>
<td>12 µg/m³ 35 µg/m³</td>
<td>12 µg/m³ --</td>
<td>Annual 24-hour</td>
</tr>
<tr>
<td>PM10</td>
<td>150 µg/m³ --</td>
<td>50 µg/m³ 20 µg/m³</td>
<td>24-hour Annual</td>
</tr>
<tr>
<td>Ozone</td>
<td>-- 0.07 ppm</td>
<td>0.09 ppm 0.07 ppm</td>
<td>1 hour 8-hour</td>
</tr>
<tr>
<td>NO₂</td>
<td>0.053 ppm 100 ppb</td>
<td>0.030 ppm 0.18 ppm</td>
<td>Annual 1-hour</td>
</tr>
<tr>
<td>SO₂</td>
<td>0.14 ppm 0.03 ppm</td>
<td>0.04 ppm --</td>
<td>24-hour Annual</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>35 ppm 9 ppm</td>
<td>20 ppm 9 ppm</td>
<td>1-hour 8-hour</td>
</tr>
<tr>
<td>Lead</td>
<td>0.15 µg/m³ Rolling 3-mo avg</td>
<td>1.5 µg/m³ 30-d avg</td>
<td></td>
</tr>
</tbody>
</table>
Area Designations for CAAQS for PM2.5
Wildfire Smoke Guidance
## Recommended Actions for Public Health Officials

<table>
<thead>
<tr>
<th>AQI Category</th>
<th>PM2.5 µg/m³ 24-hr avg</th>
<th>Recommended Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Good (0 to 50)</strong></td>
<td>0-12</td>
<td>• If smoke event forecast, implement communication plan</td>
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</tbody>
</table>
| **Moderate (51 to 100)**          | 12.1-35.4              | • Prepare for full implementation of School Activity Guidelines [link](http://www3.epa.gov/airnow/flag/school-chart-2014.pdf)  
  • Issue public service announcements (PSAs) advising public about health effects, symptoms and ways to reduce exposure  
  • Distribute information about exposure avoidance |
| **Unhealthy for Sensitive Groups (101 to 150)** | 35.5-55.4              | • Evaluate Implementation of School Activity Guidelines  
  • If smoke event projected to be prolonged, evaluate and notify possible sites for cleaner air shelters  
  • If smoke event projected to be prolonged, prepare evacuation plans |
| **Unhealthy (151 to 200)**        | 55.5-150.4             | • Full implementation of School Activity Guidelines  
  • Consider canceling outdoor events (e.g., concerts and competitive sports), based on public health and travel considerations. |
| **Very Unhealthy (201 to 300)**   | 150.5-250.4            | • Schools move all activities indoors or reschedule them to another day.  
  • Consider closing some or all schools  
  • Cancel outdoor events involving activity (e.g., competitive sports)  
  • Consider canceling outdoor events that do not involve activity (e.g. concerts) |
| **Hazardous (>300)**              | >250.5-500             | • Consider closing schools  
  • Cancel outdoor events (e.g., concerts and competitive sports)  
  • Consider closing workplaces not essential to public health  
  • If PM level is projected to remain high for a prolonged time, consider evacuation of at-risk populations |
Wildfire-related Research in California

Published Health Studies

- A number of epidemiological studies from southern California wildfires (2003, 2007)
- Increased respiratory hospital admissions, especially for asthma
  - For the very young and the elderly
- Slight reduced birthweight among infants exposure in utero
- Increased eye and respiratory symptoms in children
- CARB study on the effects of wood-burning ban in the San Joaquin Air Basin
  - PM2.5 concentrations decreased 12% after wood-burning ban
  - Hospitalizations for CVD decreased 7% after wood-burning ban
  - IHD hospitalizations decreased 16% after wood-burning ban
Wildfire-related Research in California
CARB-funded Health Studies (Lisa Miller, UC Davis)

- Cohort of 50 outdoor colony rhesus monkeys born ~ during Trinity and Humboldt County wildfires (2008)
- Impact of early life episodic ozone and PM exposure
- Blood and lung tests at age 3
  - Early life exposure to ozone and wildfire PM2.5 can result in immune and lung function decrements that persist with maturity
- Follow-up study (in progress)
  - Are adverse health effects from air pollution exposure passed on from mother to child?
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