Protection From Wildfire Smoke

An Overview of Cal/OSHA’s Regulation in Title 8 CCR §5141.1

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Presentation Objectives

- Recognize conditions that pose a health risk to employees from wildfire smoke.
- Implement controls at the work site.
- Protect workers from exposure to wildfire smoke.
- Understand how to comply with the Cal/OSHA regulation.
Basic Compliance Actions

1. Monitor the Air Quality Index (AQI) in the area, or take real-time measurements of PM2.5.
2. Communicate with employees.
3. If AQI for PM2.5 reaches 151: Protect employees from exposure.
4. Provide training on health effects, protective measures, regulation, and employee rights.
# Air Quality Index Color Chart

<table>
<thead>
<tr>
<th>Air Quality Index Levels of Health Concern</th>
<th>Numerical Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0 to 50</td>
<td>Air quality is considered satisfactory, and air pollution poses little or no risk.</td>
</tr>
<tr>
<td>Moderate</td>
<td>51 to 100</td>
<td>Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>101 to 150</td>
<td>Members of sensitive groups may experience health effects. The general public is not likely to be affected.</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>151 to 200</td>
<td>Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.</td>
</tr>
<tr>
<td>Very Unhealthy</td>
<td>201 to 300</td>
<td>Health alert: everyone may experience more serious health effects.</td>
</tr>
<tr>
<td>Hazardous</td>
<td>301 to 500</td>
<td>Health warnings of emergency conditions. The entire population is more likely to be affected.</td>
</tr>
</tbody>
</table>
Camp Fire Smoke Plume
Woolsey Fire in Ventura County
Wildfire Smoke Plumes 11/9/18
SF Bay Area Air Quality Nov. 8 & 10

Daily Combined AQI
Thursday, November 8, 2018
San Francisco
Oakland
Livermore
San Jose
San Rafael
Antioch
Vacaville
Santa Rosa

Daily Combined AQI
Saturday, November 10, 2018
San Francisco
Oakland
Livermore
San Jose
San Rafael
Antioch
Vacaville
Santa Rosa
Wildfire Smoke Composition

- PM2.5: Fine Particulate Matter < 2.5 microns:
  - Char: keeps part of original plant cell structure
  - Ash: minerals from char combustion

- Heavy metals (As, Pb, Ni, Cd, Cr)

- Polycyclic aromatic hydrocarbons (PAHs)
Particulate Matter Diameters

- PM<sub>2.5</sub>: Combustion particles, organic compounds, metals, etc., < 2.5 μm (microns) in diameter
- PM<sub>10</sub>: Dust, pollen, mold, etc., < 10 μm (microns) in diameter
- Human hair: 50-70 μm (microns) in diameter
- Fine beach sand: 90 μm (microns) in diameter

Image courtesy of the U.S. EPA
Health Issues of Particle Pollution

- Irritation of the eyes, nose and throat
- Coughing, chest tightness and shortness of breath
- Asthma attacks
- Reduced lung function
- Irregular heartbeat
- Heart attacks
- Ischemic Stroke, Alzheimer’s Disease
- Premature death in people with heart or lung disease
Health Effects From 2007 San Diego Wildfires

- Outpatient visits for acute bronchitis were 72% higher in the 5-day period after the peak fire.
- ED visits for asthma went up 73% on days with an AQI for PM2.5 of 101–150
- Increases in respiratory problems during wildfires can be expected even at mildly degraded levels of air quality.
Health Risk from Smoke Inhalation during 2015 Wildfires

At AQI 44 to 71 (< ½ Cal/OSHA PM2.5 level) Higher risk:

- Asthma for ages 19–44
- COPD & high blood pressure for Ages 45–64
- Respiratory illness for all working age adults
- Emergency visits for cardiovascular disease increased for all working age adults.
Regulatory Thresholds

1. Employees may be reasonably expected to be exposed to wildfire smoke, and

2. PM2.5 AQI = 151 or above.

Outdoor occupations: construction, utilities, agriculture, landscaping, recreation, billposting, tree trimming, roofing.

Indoor/outdoor jobs: delivery drivers, sales & service personnel, law enforcement, EMTs.
Exceptions to the Regulation

- Work in enclosed buildings or vehicles with mechanical air filtration.
  - All openings must be kept closed to minimize outdoor contamination.
- Exposed for one hour or less during shift.
- Firefighters engaged in wildland firefighting.
- Where employer demonstrates that AQI for PM 2.5 is less than 151 at the work site.
Compliance Preparations

- Make plans for prompt medical treatment of injured or ill employees.
- Provide respirators for voluntary use.
- Train employees.
- Written program is not required but it’s a good idea to adapt H&S Plan or IIPP.
What to Do If Wildfires Affect Air Quality

- Check current and forecast AQI at start of shift and periodically during work shift.
  - By Zip Code at https://www.airnow.gov/
  - or measure air quality directly.

- Communicate with employees in a readily understandable form.

- Provide ways to reduce exposure.
What is the Air Quality Index?

<table>
<thead>
<tr>
<th>Air Quality Index (AQI) Values</th>
<th>Levels of Health Concern</th>
<th>Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the AQI is in this range:</td>
<td>...air quality conditions are:</td>
<td>...as symbolized by this color:</td>
</tr>
<tr>
<td>0 to 50</td>
<td>Good</td>
<td>Green</td>
</tr>
<tr>
<td>51 to 100</td>
<td>Moderate</td>
<td>Yellow</td>
</tr>
<tr>
<td>101 to 150</td>
<td>Unhealthy for Sensitive Groups</td>
<td>Orange</td>
</tr>
<tr>
<td>151 to 200</td>
<td>Unhealthy</td>
<td>Red</td>
</tr>
<tr>
<td>201 to 300</td>
<td>Very Unhealthy</td>
<td>Purple</td>
</tr>
<tr>
<td>301 to 500</td>
<td>Hazardous</td>
<td>Maroon</td>
</tr>
</tbody>
</table>

- Health effects of six pollutants (PM, CO, Pb, NO₂, SO₂, Ozone)
- AQI 100 corresponds to NAAQS level that protects public health
Where to Find Your Area AQI

https://www.airnow.gov/index.cfm?action=aqibasics.aqi

AirNow Home >> California >> San Diego Coast

Data and Forecasts courtesy of:
Antelope Valley Air Quality Management District, Bay Area Air Quality Management District, California Air Resources Board, Imperial County Air Pollution Control District, Mendocino County Air Quality Management District, Mojave Desert Air Quality Management District, Monterey Bay Air Resources District, Placer County Air Pollution Control District, Sacramento Metropolitan Air Quality Management District, San Diego County Air Pollution Control District, San Joaquin Valley Air Pollution Control District, San Luis Obispo County Air Pollution Control District, Santa Barbara County Air Pollution Control District, Siskiyou County Air Pollution Control District, South Coast Air Quality Management District, Ventura County Air Pollution Control District, Yolo-Solano Air Quality Management District.

Current Conditions

Air Quality Index (AQI) observed at 14:00 PDT

44 Good

Health Message: None

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available here.

AQI - Pollutant Details

Ozone 33 Good

Particles (PM2.5) 44 Good

Air Quality Forecast

<table>
<thead>
<tr>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Converting AQI to concentration
airnow.gov/index.cfm?action=airnow.calculator

AQI Calculator

DIRECTIONS: Choose the tab for AQI to Concentration or the tab for Concentration to AQI. Select a pollutant, then enter the AQI value or the concentration (in units). Click on “Calculate” to see the results.

Select a Pollutant
PM2.5 - Particulate <2.5 microns (24hr avg) ▼

Enter the AQI: 151 Calculate Reset

Concentration Units: AQI Category
55.5 µg/m³ Unhealthy

Sensitive Groups
People with respiratory or heart disease, the elderly and children are the groups most at risk.

Health Effects
Increased aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; increased respiratory effects in general population.

Cautionary
People with respiratory or heart disease, the elderly and children should avoid prolonged exertion; everyone else should limit prolonged exertion.
Two-Way Communication

- Communicate smoke hazard to employees in a form that is readily understandable.
- Inform employees of:
  - current AQI for PM2.5.
  - available protective measures
- Encourage employees to report:
  - wildfire smoke hazards
  - worsening conditions
  - smoke exposure symptoms
Employee Training

- Health effects of wildfire smoke.
- What AQI means and where to find it.
- What to do to protect themselves from smoke exposure.
- Right to seek medical treatment without fear of reprisals.
- The employer requirements
Engineering Control Strategies

- Reduce PM2.5 exposure to below AQI 151 or as much as feasible:
  - Air filtration
  - Ventilation

- If Engineering Controls do not reduce exposure implement administrative control strategies
Administrative Controls

- Move to areas below AQI 151.
- Change work hours.
- Reduce time in areas with unfiltered air.
- Additional breaks.
- Reduce work intensity.
Respiratory Protection

At PM2.5 AQI 151 to 500:

- NIOSH-certified
- Filtering face piece
- N, O, P–95 to 100.

- Encourage voluntary use.
Voluntary Use Respirator Training

- The importance, limitations, and benefits of wearing a respirator when exposed to wildfire smoke.
- How to properly don and wear the respirator.
- How to clean, store, maintain, and replace it.
- Can follow Appendix D of Section 5144
Mandatory Use Respirator Use

- When PM2.5 AQI exceeds 500 (0.5 mg/m³).
- Respiratory Protection Section 5144 applies.
- Provide respirator with Assigned Protection Factor of 10 or more.
- Require medical evaluation, fit testing, and change out schedules.
Measuring PM2.5 at Worksite

- Direct-reading dust monitor tracks real-time conditions.
- More precise readings of air quality.
- Must not underestimate exposure.
- Trained operator directs monitoring and knows how to interpret results.
Direct Reading Instruments

Nanozen

Airbeam2

TSI Dustrak DRX
## PM2.5 Meter Comparison Chart

<table>
<thead>
<tr>
<th>Features</th>
<th>Dustrak DRX</th>
<th>Nanozen</th>
<th>AirBeam2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size selector</td>
<td>Plug in</td>
<td>Plug in</td>
<td>Built-in</td>
</tr>
<tr>
<td>PM2.5 Accuracy</td>
<td>Overestimate</td>
<td>Overestimate</td>
<td>Accurate</td>
</tr>
<tr>
<td>Correction Factor</td>
<td>Programmable</td>
<td>Programmable</td>
<td>Complicated</td>
</tr>
<tr>
<td>Sampling Filter</td>
<td>Built-in</td>
<td>Built-in</td>
<td>External</td>
</tr>
<tr>
<td>User Friendly</td>
<td>Easy</td>
<td>Easy</td>
<td>Very Easy</td>
</tr>
<tr>
<td>Units</td>
<td>µg/m3</td>
<td>µg/m3</td>
<td>µg/m3 &amp; AQI</td>
</tr>
<tr>
<td>Display</td>
<td>Integrated</td>
<td>Integrated</td>
<td>Android app</td>
</tr>
<tr>
<td>Data Connectivity</td>
<td>Download data</td>
<td>Download data</td>
<td>Cast to Cloud</td>
</tr>
<tr>
<td>Cost</td>
<td>$9,500</td>
<td>$4,900</td>
<td>$249+android</td>
</tr>
<tr>
<td>Suitable for</td>
<td>Compliance</td>
<td>Compliance</td>
<td>Screening</td>
</tr>
</tbody>
</table>
# Pros and Cons of AQI vs Meter

<table>
<thead>
<tr>
<th>AQI Index</th>
<th>Particle Meter</th>
</tr>
</thead>
</table>

**PROS:**
- Accessible data
- Units in AQI index
- No equipment cost
- No operator training

**CONS:**
- Work subject to AQI
- Daily levels only
- Few monitoring stations

**PROS:**
- Site-specific levels
- Real-time data
- Control work schedule

**CONS:**
- Equipment cost
- Operator training
- Convert units to AQI
- Background levels
In Review: Connecting the Dots

- Wildfire smoke degrades air quality for weeks after the peak fire.
- Smoke travels far from actual fire source.
- 90% of smoke particulates are PM2.5.
- Inhaling PM2.5 has serious short and long-term health effects to working age adults.

- Plan how to respond to wildfire conditions.
To Do’s Before the Wildfire

Know how to:

- Monitor the Air Quality Index.
  - Or use a direct-reading instrument.
- Communicate with workers.
- Apply engineering and administrative controls to reduce exposures.
- Select and stock respirators for voluntary use.
- Conduct training.
Questions?

THANK YOU

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