



SOMETHING'S IN THE AIR: USING AIR QUALITY MONITORING TOOLS TO TRAIN ON WILDFIRE SMOKE HAZARDS

Kevin Riley, PhD, MPH

UCLA Labor Occupational Safety & Health (LOSH) Program

Western Region Universities Consortium (WRUC)

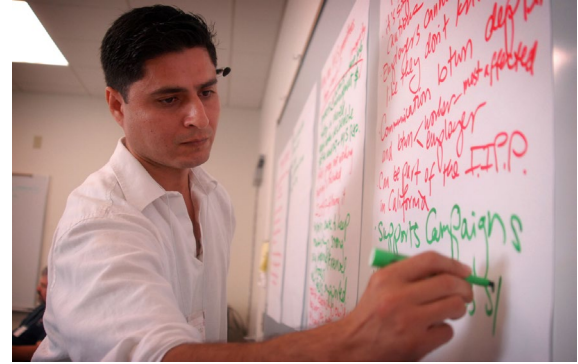
NIEHS National Trainers' Exchange, May 2023

UCLA

Labor Occupational Safety & Health Program

Resource on safety and health
issues for workers in Southern
California:

- Training
- Technical assistance
- Research
- Leadership development





WESTERN
REGION
UNIVERSITIES
CONSORTIUM



University of Washington

UC Berkeley Labor Occupational Health
Program (LOHP)



**UCLA Labor Occupational Safety and
Health (LOSH) Program**

Arizona State University

Objectives

At the end of this workshop, you will be able to:

- Describe strategies that may be used in training workers on air quality hazards caused by wildfires
- Name the states that currently have OSHA standards to protect outdoor workers from PM2.5 in wildfire smoke
- Use publicly available tools for monitoring PM2.5
- Consider how these tools could be integrated into your own training

Wildfires in the Western U.S.



Bootleg Fire, Oregon, July-Aug 2021







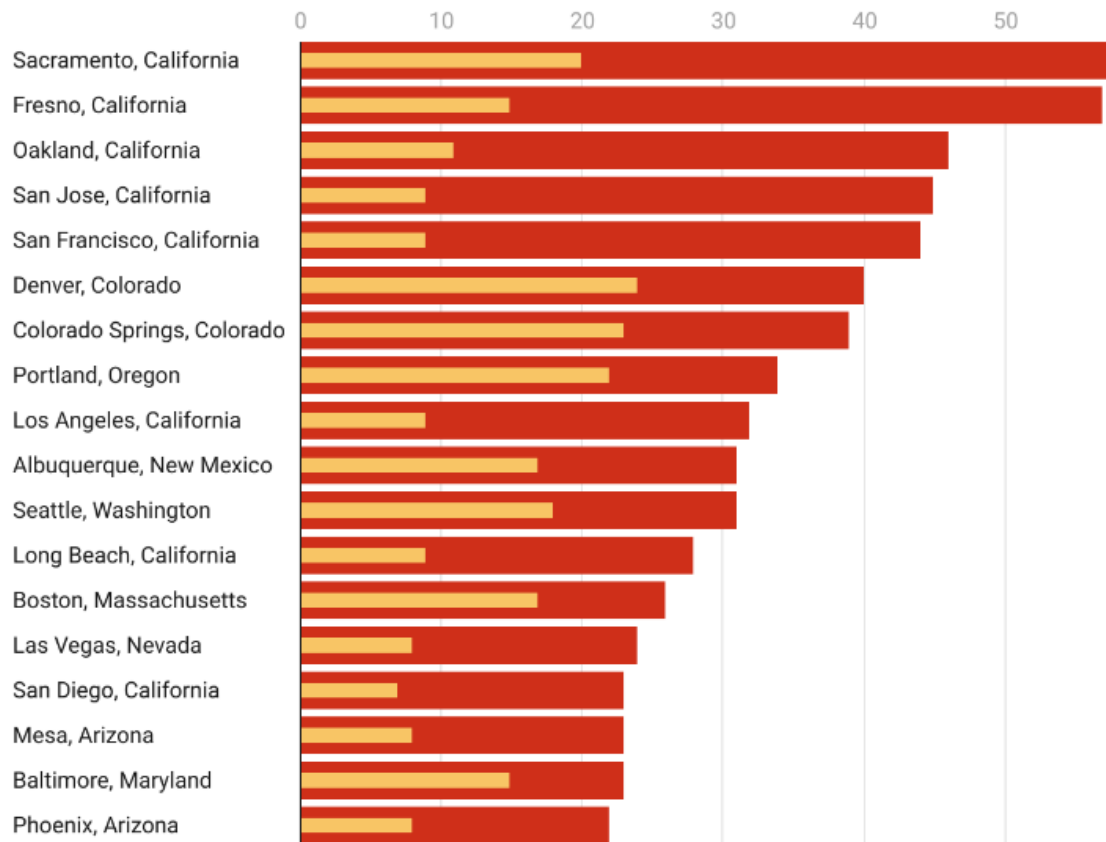
Image 1: Smoke from the 2018 Camp Fire, Paradise, CA



Image 2: Smoke from the 2018 Camp Fire lingered in Oakland, CA, 170 miles away

Major cities with significant increases in smoke days

Smoke days (2016-2020) Smoke days (2009-2013)



SOURCE: Dangerous Air: As California Burns, America Breathes Toxic Smoke, KQED Sept 2021 <https://www.kqed.org/news/11890211/dangerous-air-as-california-burns-america-breathes-toxic-smoke>

What type of workers may be exposed to wildfire smoke?



Composition of Wildfire Smoke

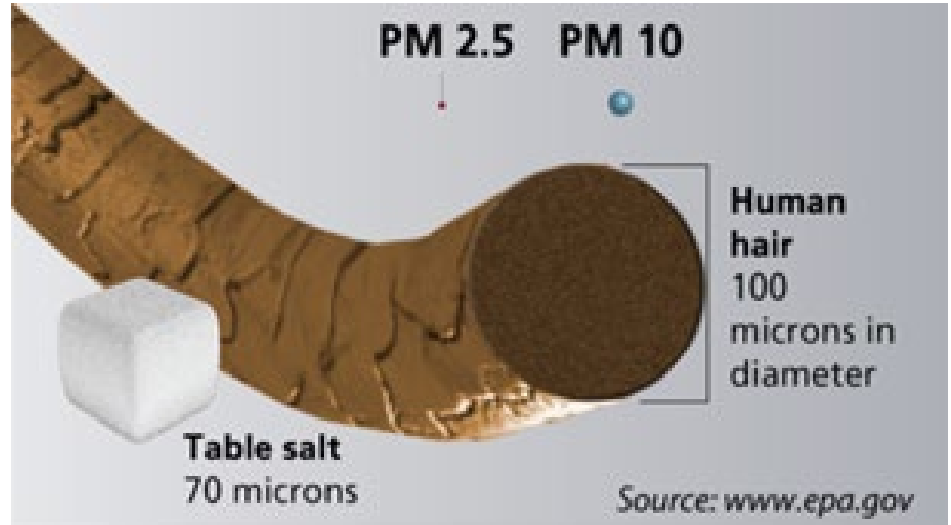
- **Primary air pollutants:**
 - Carbon monoxide (CO)
 - Nitrogen dioxide (NO₂)
 - Polycyclic aromatic hydrocarbons (PAHs)
 - Volatile organic compounds (VOCs)
 - Particulate matter (PM_{2.5})
- **Secondary air pollutants:**
 - Particulate matter >2.5 microns (e.g., ash, metals, asbestos fibers, etc.)
 - Ground-level ozone (O₃)
- **Wildfire smoke exposure is associated with increased rates of emergency room visits for heart and breathing-related problems**

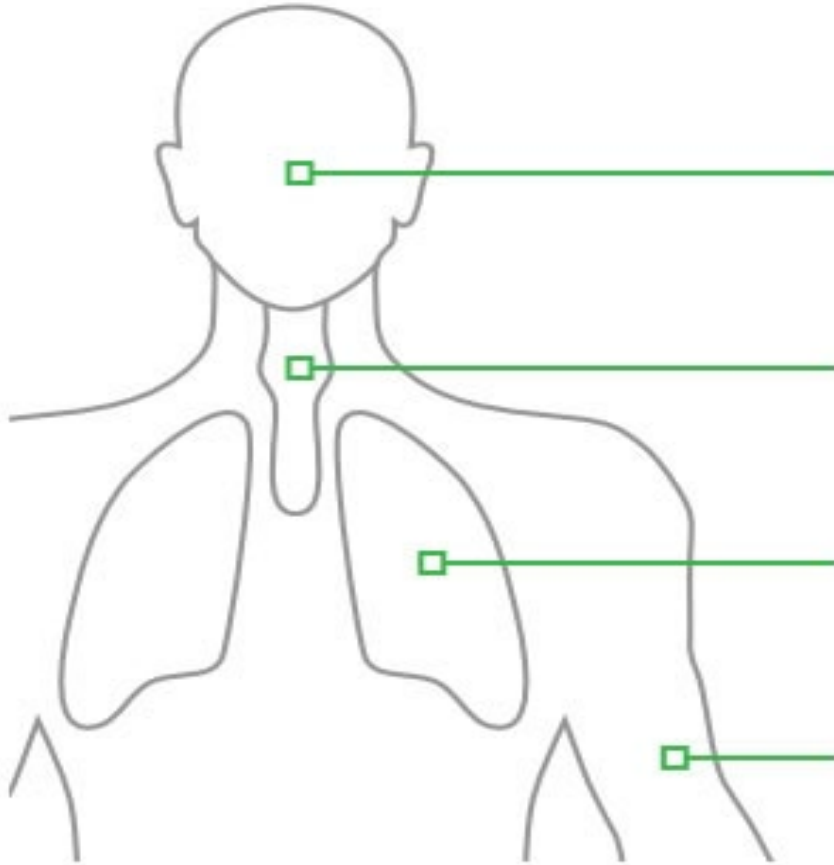
Composition of Wildfire Smoke

- **Primary air pollutants:**
 - Carbon monoxide (CO)
 - Nitrogen dioxide (NO₂)
 - Polycyclic aromatic hydrocarbons (PAHs)
 - Volatile organic compounds (VOCs)
 - **Particulate matter (PM2.5)**
- **Secondary air pollutants:**
 - Particulate matter >2.5 microns (e.g., ash, metals, asbestos fibers, etc.)
 - Ground-level ozone (O₃)
- **Wildfire smoke exposure is associated with increased rates of emergency room visits for heart and breathing-related problems**

PM2.5

- Particles (or “particulate matter”) with a diameter of 2.5 microns or less
- About 3% the thickness of a strand of human hair





100 PM

Trapped in the nose

10 PM

Trapped in the throat

2.5 PM

Reaches deep into the lungs

1 PM

Enters the bloodstream

Air Quality Index (AQI) for PM2.5

Air Quality Index - Particulate Matter	
301 – 500	Hazardous
201 – 300	Very Unhealthy
151 – 200	Unhealthy
101 – 150	Unhealthy for Sensitive Groups
51 – 100	Moderate
0 – 50	Good

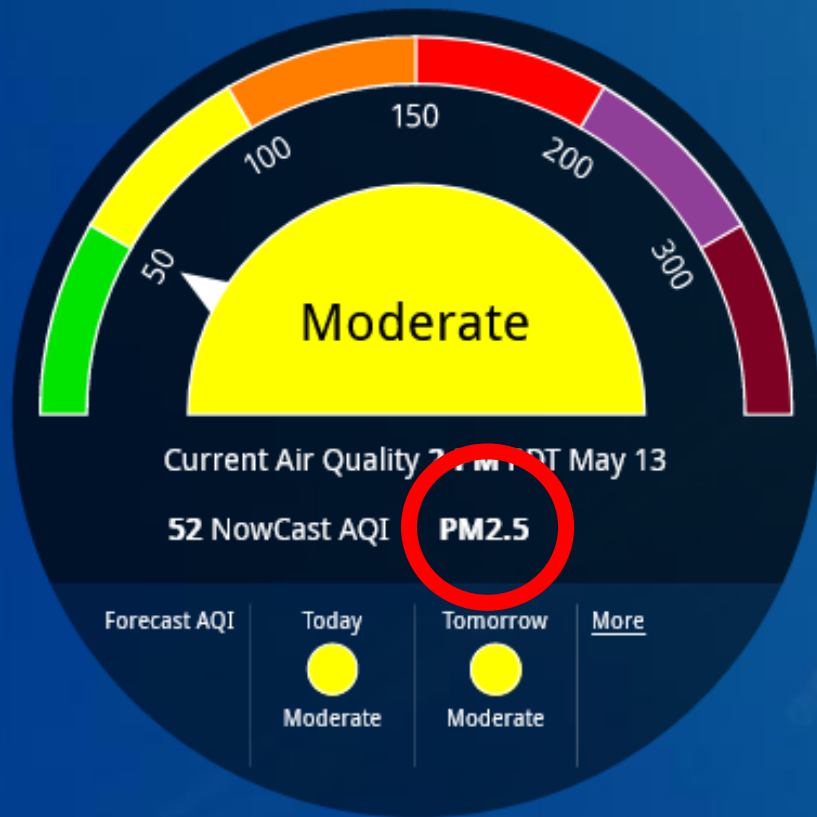
How to Check the Latest Air Conditions

- U.S. EPA AirNow: www.AirNow.gov
- U.S. Forest Service: <https://tools.airfire.org>
- South Coast Air Quality Management District: www.aqmd.gov
- Weather app on smartphone



- Real-time AQI for any location in the U.S is available at:
[AirNow.gov](https://www.airnow.gov)





ZIP Code, City, or State

Compton, CA

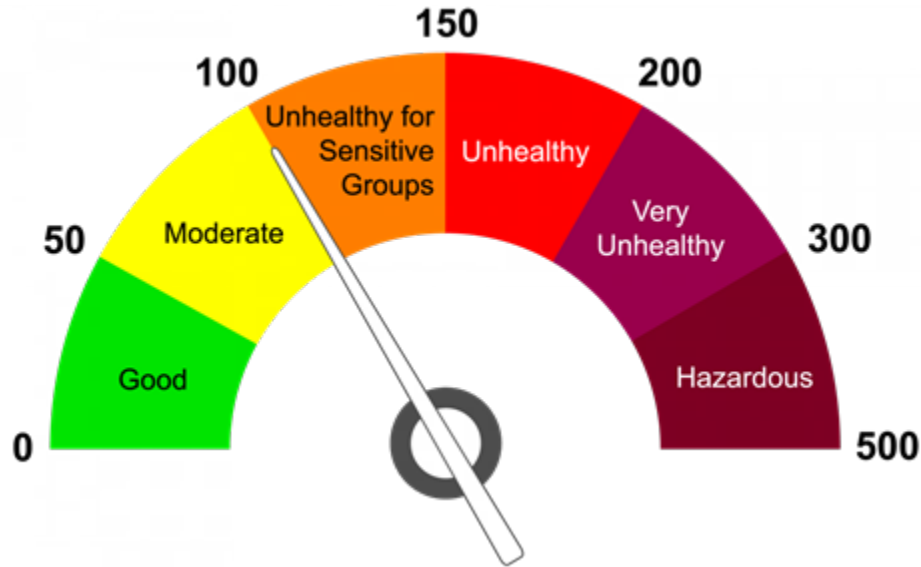
S Central LA CO Reporting Area

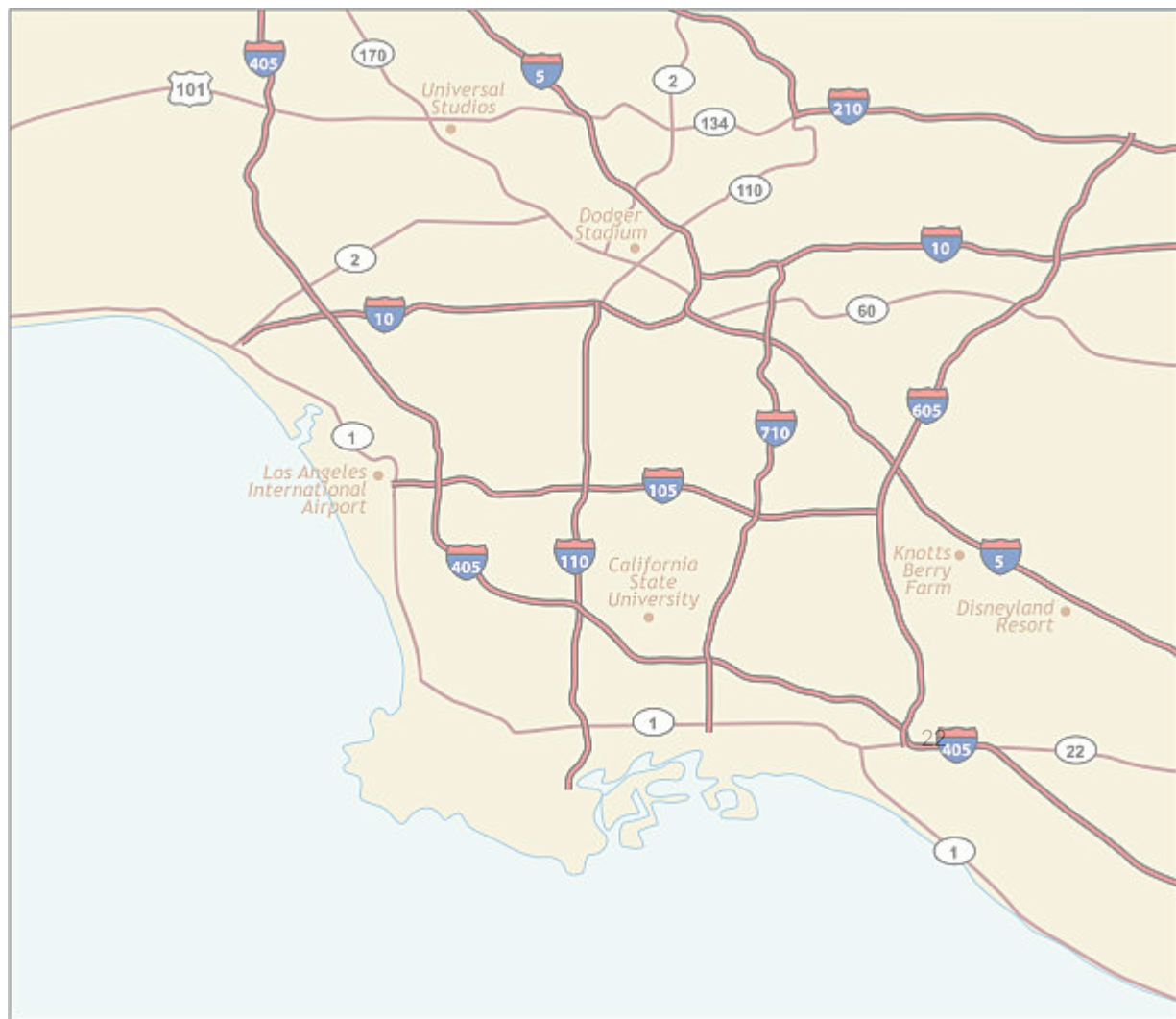
Monitors Near Me

Recent Trends

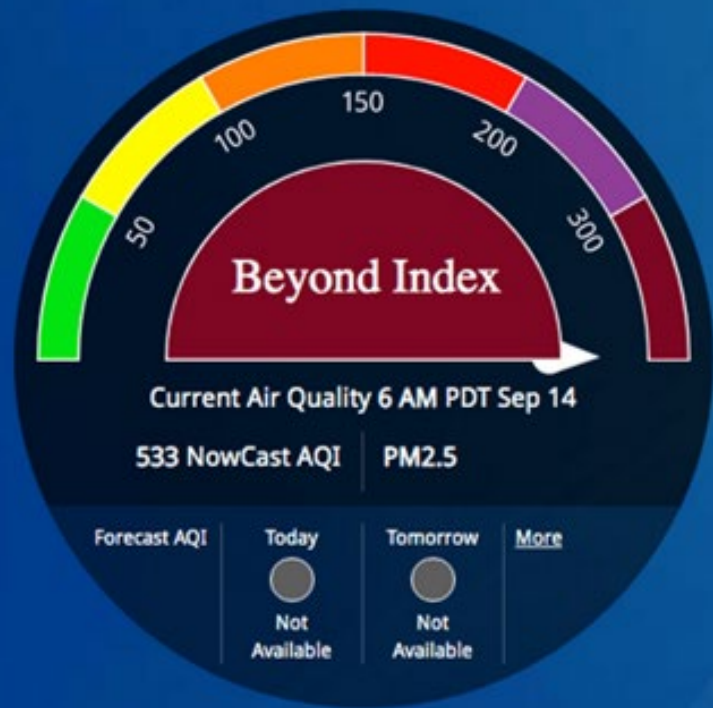
U.S. EPA: [AirNow.gov](https://www.airnow.gov)

Visit EPA's Air Now site (www.airnow.gov) and enter your location. What is your location and the current AQI for PM2.5?









ZIP Code, City, or State

Vancouver, WA

Vancouver Reporting Area

[Monitors Near Me](#)

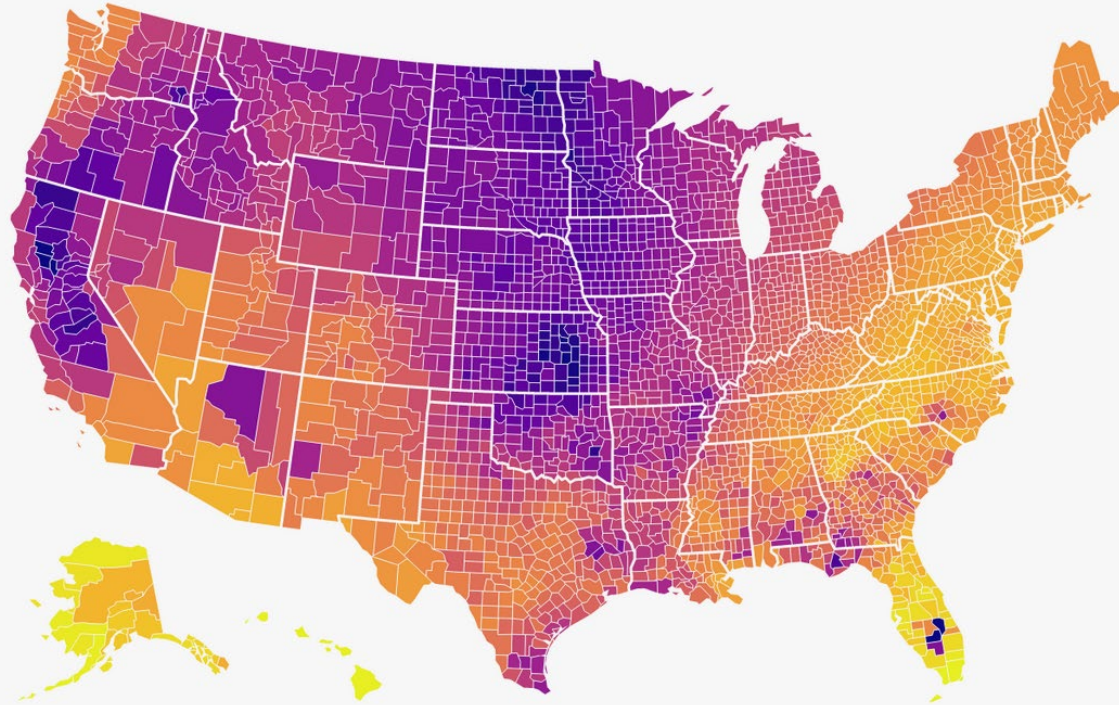
[Recent Trends](#)

OSHA Standards for Wildfire Smoke Protections

**How many states currently
have OSHA standards for
wildfire smoke protections?**

Wildfire smoke exposure across U.S. counties, 2016-2020

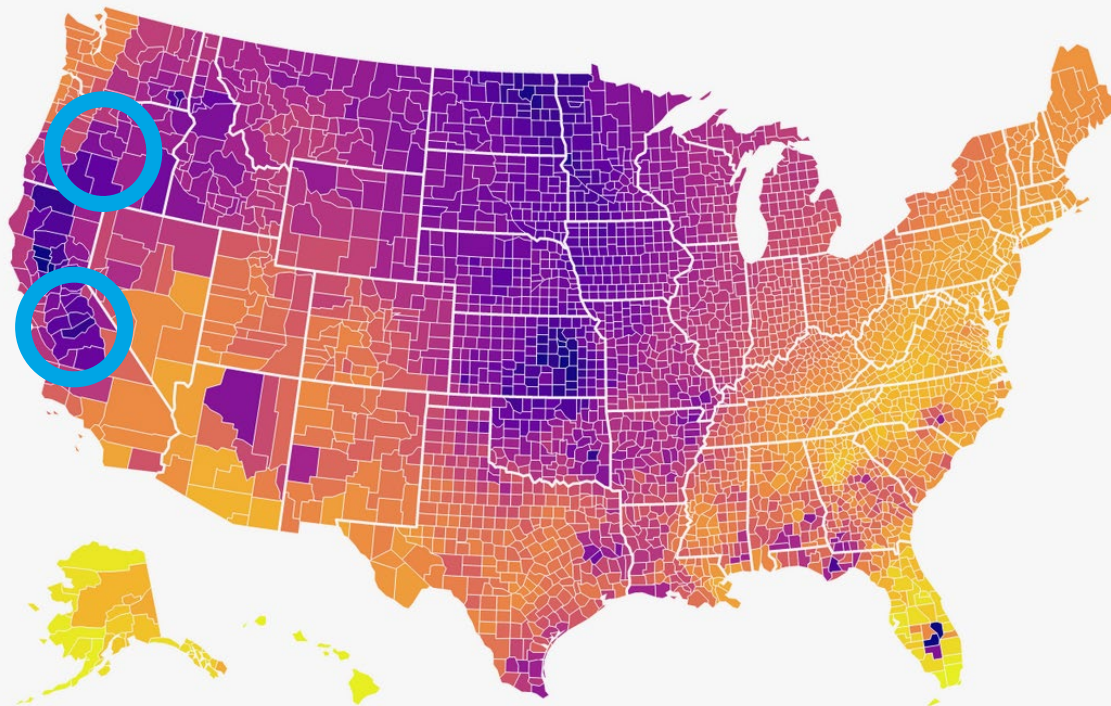
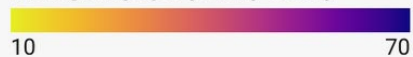
Average days per year by county



Map: Alison Saldanha • Source: Analysis of National Oceanic and Atmospheric Administration satellite imagery by NPR's California Newsroom and Stanford University's Environmental Change and Human Outcomes Lab • Created with Datawrapper

Wildfire smoke exposure across U.S. counties, 2016-2020

Average days per year by county



Map: Alison Saldanha • Source: Analysis of National Oceanic and Atmospheric Administration satellite imagery by NPR's California Newsroom and Stanford University's Environmental Change and Human Outcomes Lab • Created with Datawrapper

OSHA Standards for Wildfire Smoke Protection

	Effective Date	Initial Trigger for Controls	Trigger for Mandatory Resp. Protection
California (Cal/OSHA)	<i>First emergency rule:</i> July 2019 <i>Permanent rule:</i> Feb 2021	<i>AQI for PM2.5 =</i> 151 or above	<i>AQI for PM2.5 =</i> above 500
Oregon (Oregon OSHA)	<i>First emergency rule:</i> Aug 2021 <i>Permanent rule:</i> July 2022	<i>AQI for PM2.5 =</i> 101 or above	<i>AQI for PM2.5 =</i> 251 or above NOTE: Medical evaluations and fit testing only required when AQI for PM2.5 is 501 or above
Washington (Dept. of Labor & Industries)	<i>First emergency rule:</i> July 2021 (expired Sept 2022) <i>Permanent rule:</i> In process	<i>AQI for PM2.5 =</i> 101 or above	<i>AQI for PM2.5 =</i> 500 or above

Wildfire Smoke Standards: Who do they apply to and when?

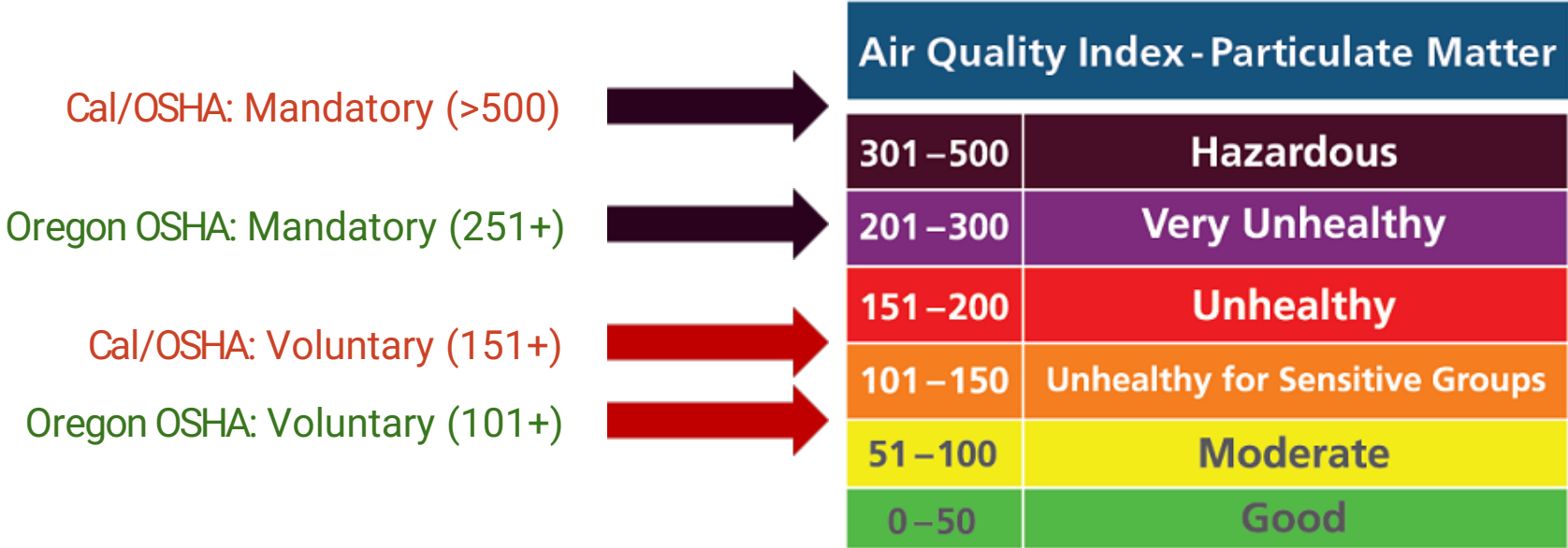
- Application: Workers in outdoor work settings or indoor work settings without air filtration by a mechanical ventilation system
- Exceptions: wildland firefighters; emergency operations; intermittent work activities (e.g., exposures less than one hour per shift)



Wildfire Smoke Standards: Basic requirements

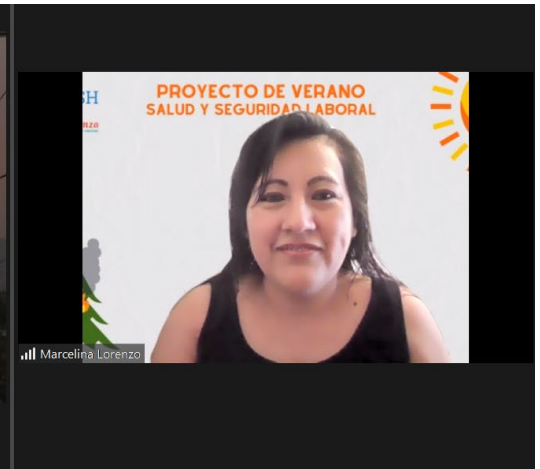
- **Provide training on hazards of wildfire smoke**
- **AQI monitoring** - Before each shift and periodically throughout workday - using forecasts or direct measurement
- **Communicate AQI monitoring results to employees**
- **Reduce exposure to PM2.5** - Provide enclosed buildings, structures, or vehicles with filtered air; relocate work; change work schedules; reduce work intensity

Wildfire Smoke Standards: Respiratory protection



Training Workers on Hazards of Wildfire Smoke





Smoke Exposure in the Workplace

How does wildfire smoke affect air quality?

Wildfire smoke is a mix of gas and tiny particles, as well as ash from everything that is burning in a fire. The smoke pollutes the air, which is why the sky becomes dark and smoky.

Why is wildfire smoke dangerous?

The main harmful pollutants are the tiny particles called particulate matter (PM) that measure 2.5 microns or less. The particles are much smaller than a grain of sand and can enter the bloodstream through the lungs when they are breathed in.

Grain of Sand
90 μ m (microns)

Particulate Matter
2.5 μ m (microns)

Air Quality Index (AQI)

The AQI shows how polluted the air is in a specific location. You can check the AQI for PM2.5 at www.airnow.gov.

301-500	Hazardous
201-300	Very Unhealthy
151-200	Unhealthy
201-300	Unhealthy for Sensitive Groups
51-100	Moderate
0-50	Good

Wildfire Smoke Exposure Symptoms

Short-term Symptoms



Long-term Symptoms

- Reduced lung function
- Chronic bronchitis
- Worsening of asthma
- Heart failure

People at Higher Risk for Symptoms

- Adults over 65
- Children
- Pregnant people
- People with existing heart and lung conditions

Protection from Wildfire Smoke

The Cal/OSHA Protection from Wildfire Smoke standard (Section 5141.1) requires employers to reduce workers' exposure to wildfire smoke when the AQI for PM2.5 reaches 151 or higher, for one continuous hour or longer per work shift.

Workers are protected in California regardless of immigration status. The standard does not apply to wildland firefighters or workers in enclosed buildings, structures, or vehicles with filtered air.



What is the employer required to do?



Check the AQI throughout the day and communicate with workers.



Provide training on smoke exposure symptoms, how to receive medical treatment, and how they will protect workers.



When the AQI reaches 151:

- ▶ Provide clean respirators for voluntary use.
- ▶ Reduce smoke exposure by relocating the work, changing work schedules, lessening work intensity, or providing additional rest breaks.



When the AQI reaches 500 or higher, employers must require workers to wear respirators if work has not been relocated or postponed.

How to wear a respirator properly



- 1 Pull bottom strap over head and place on lower part of head, below ears.
- 2 Pull top strap over head and place on top of head.
- 3 Press gently on nose piece.
- 4 Check for air leaks by placing both hands gently on mask and breathing in and out. If the respirator does not sink a little when you breathe in, adjust the straps and the nose piece.
- 5 Employers should provide a new respirator at the beginning of each shift or if it becomes dirty or damaged.



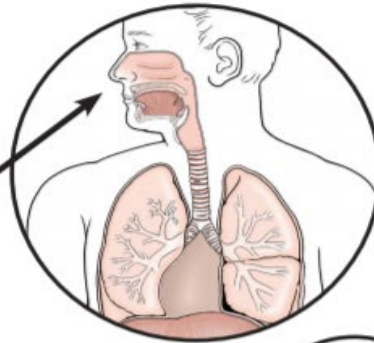
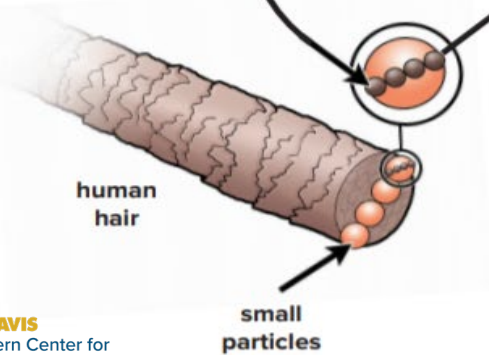
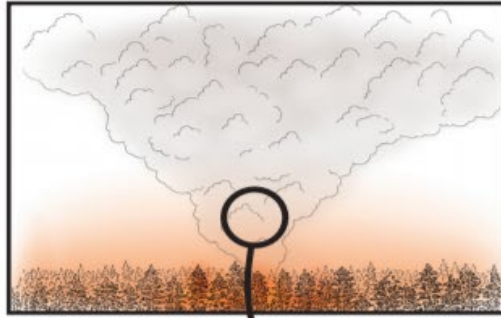
Those who suffer from any pre-existing conditions or are pregnant should check with a healthcare provider before wearing a respirator.

Regardless of immigration status, any worker can contact Cal/OSHA if they believe their workplace is not safe. Former employees and community members can also contact Cal/OSHA on a worker's behalf.





Health Effects of Wildfires



burning eyes



runny nose



chest pain



fatigue



rapid heartbeat



difficulty breathing

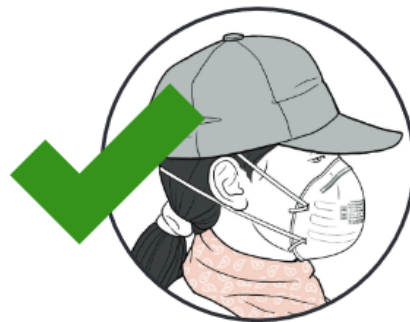


coughing



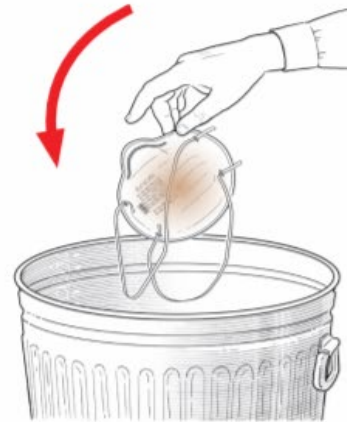
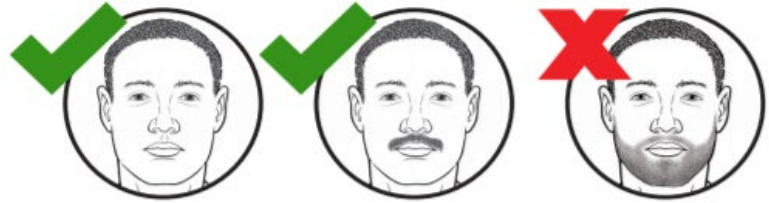
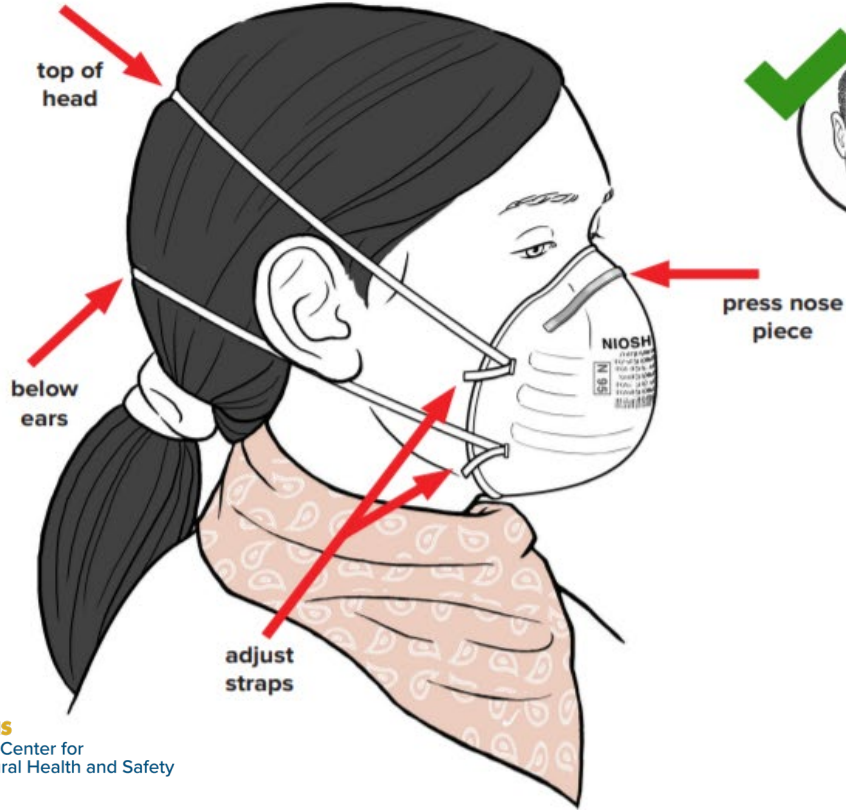
Monitoreo del Índice de la Calidad del Aire para PM2.5

Índice de la Calidad del Aire	
301–500	Peligroso
201–300	Muy dañino
151–200	Dañino
101–150	Dañino para grupos susceptibles
51–100	Moderado
0–50	Bueno





Respirators





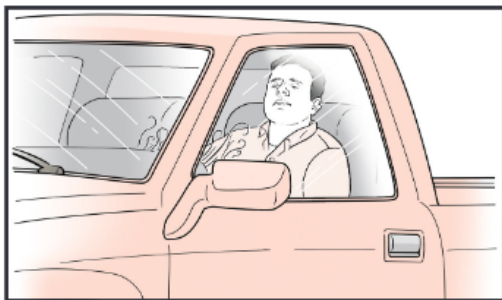
El sitio de trabajo y avisos



más espacio



avise a un supervisor



**descanse en un área con
filtración del aire**



busque atención médica

ACTIVITY:
**Applying the Cal/OSHA
Wildfire Smoke Protection
Standard**



U.S. EPA: [AirNow.gov](https://www.airnow.gov)

**Can you see ways to integrate
these tools into your own
training?**

Resources

Resources

UCLA LOSH: <https://losh.ucla.edu>

UC Davis Western Center for Agricultural Health & Safety:
<https://aghealth.ucdavis.edu/>

Oregon OSHA: <https://osha.oregon.gov/>

Washington Dept. of Labor & Industries: <https://lni.wa.gov/>

THANK YOU

Kevin Riley, PhD MPH

UCLA Labor Occupational Safety and Health Program

kriley@irle.ucla.edu

UCLA

**Labor Occupational
Safety & Health Program**



**WESTERN
REGION
UNIVERSITIES
CONSORTIUM**