

# Wildfire Smoke

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California Area Indian Health Service

# Overview

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- What is in wildfire smoke?
- Who is most at risk for harm?
- How does wildfire smoke affect your health?
- Does heat make it worse?
- What to do when there is wildfire smoke?
- Preparing now for wildfire season.



# What is in Wildfire Smoke?

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# Wildfire Smoke is a mixture

Wildfire smoke is a mixture of gases, particles and water vapor

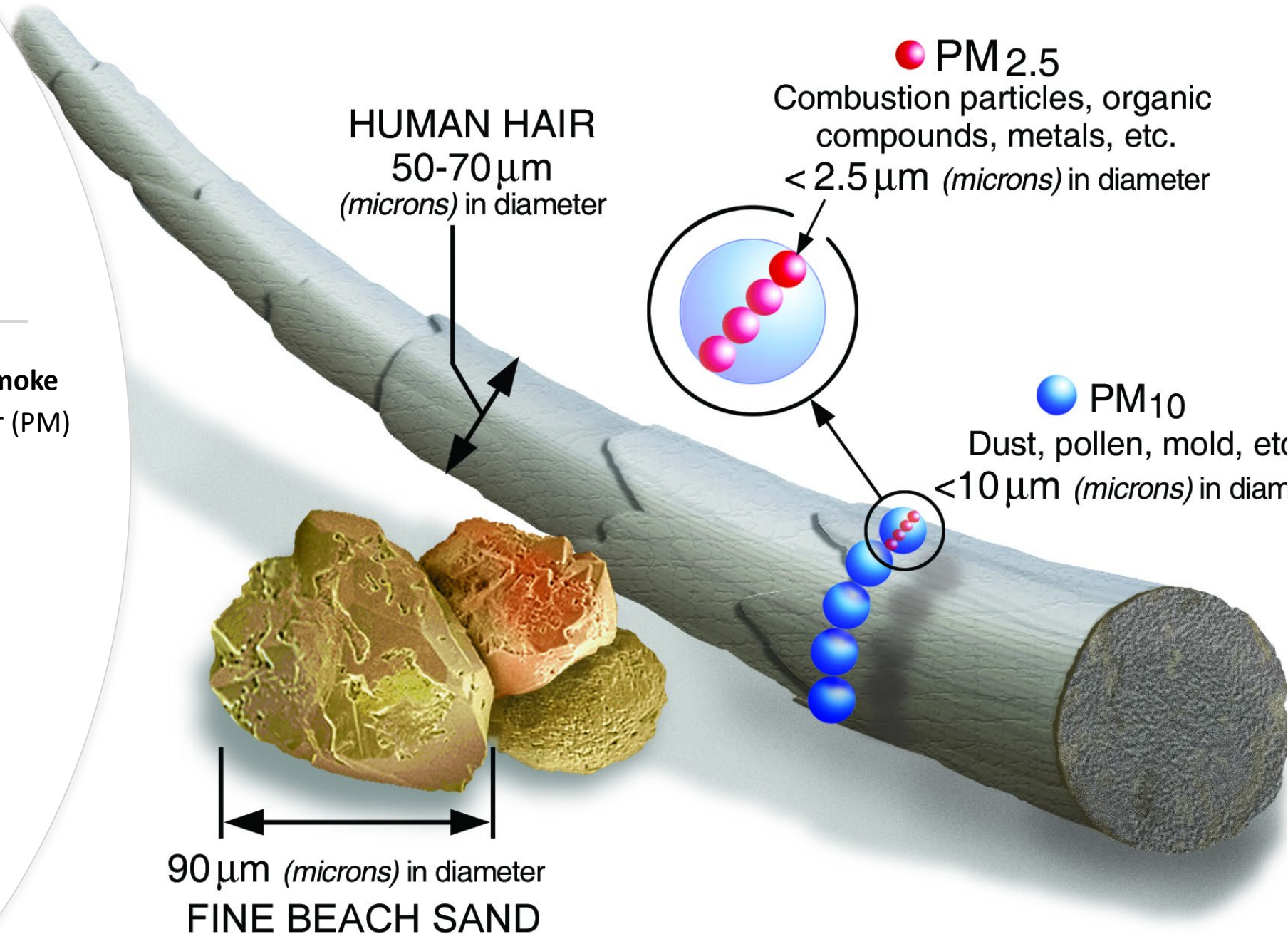
Small particles make up the bulk (90% by weight) of wildfire smoke

Some of the gases in wildfire smoke are dangerous and/or irritating

- Carbon Monoxide
- Ozone
- Volatile Organic Compounds

# What is most harmful in wildfire smoke?

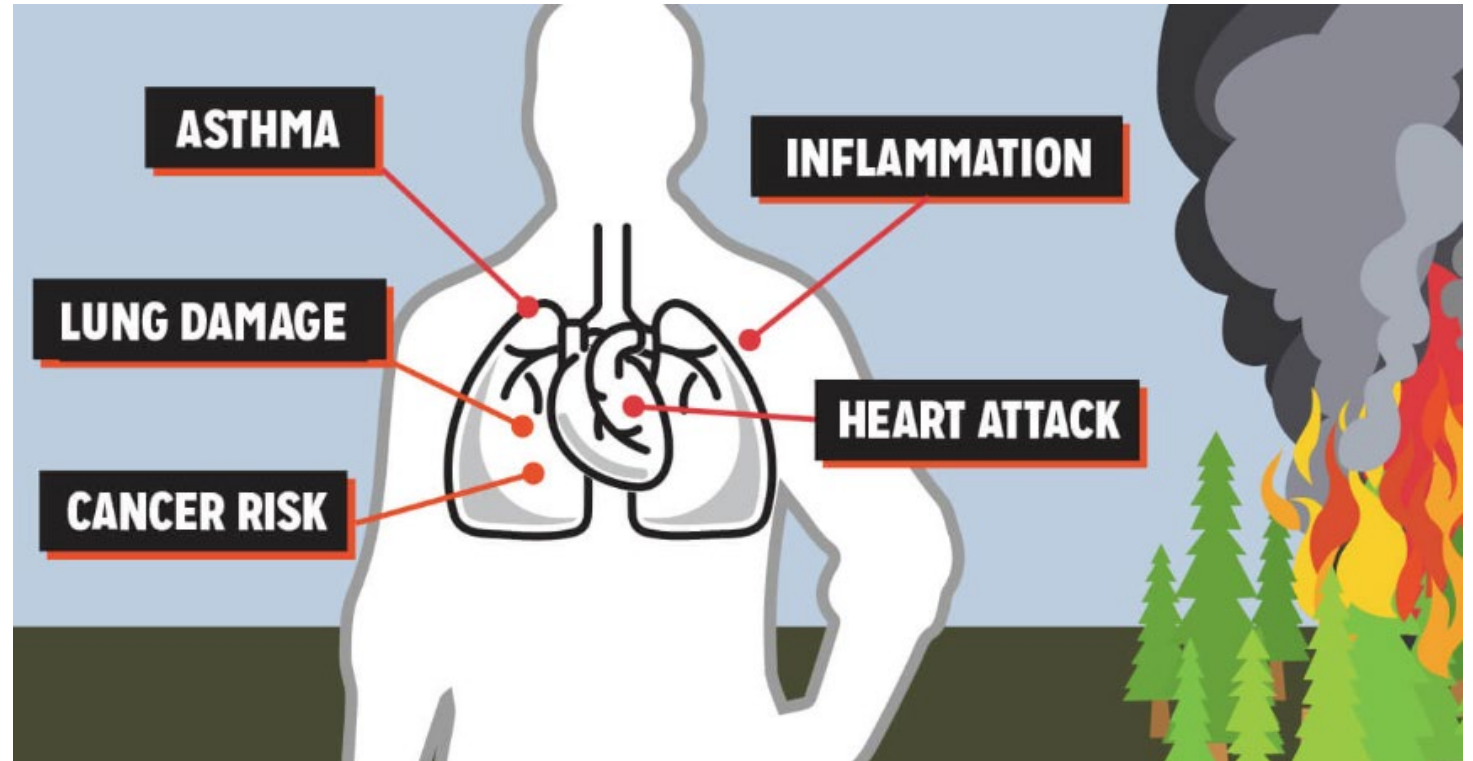
- **Tiny Particles of Carbon in Wildfire Smoke**
  - Referred to as Particulate Matter (PM)
  - 2 size groups:
    - PM 2.5
    - PM 10



# How PM 2.5 Harms Health

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- PM 2.5 particles travel deep into lungs and enter bloodstream.
  - This damages the lungs and reduces how well your lung work.
    - This can put strain on your heart
    - This strain may trigger a heart attack
  - When PM 2.5 particles enter the bloodstream it can create inflammation in the body
  - Some PM 2.5 particles may increase lung cancer risk





How does  
wildfire  
smoke affect  
your health?

## SYMPTOMS OF **SMOKE EXPOSURE**

HEADACHES \_\_\_\_\_

FATIGUE \_\_\_\_\_

WATERY, DRY EYES \_\_\_\_\_

COUGHING OR WHEEZING \_\_\_\_\_

THROAT, LUNG, OR  
SINUS IRRITATION \_\_\_\_\_

SHORTNESS  
OF BREATH OR  
ASTHMA ATTACKS \_\_\_\_\_

IRREGULAR  
HEARTBEAT \_\_\_\_\_  
OR CHEST PAIN





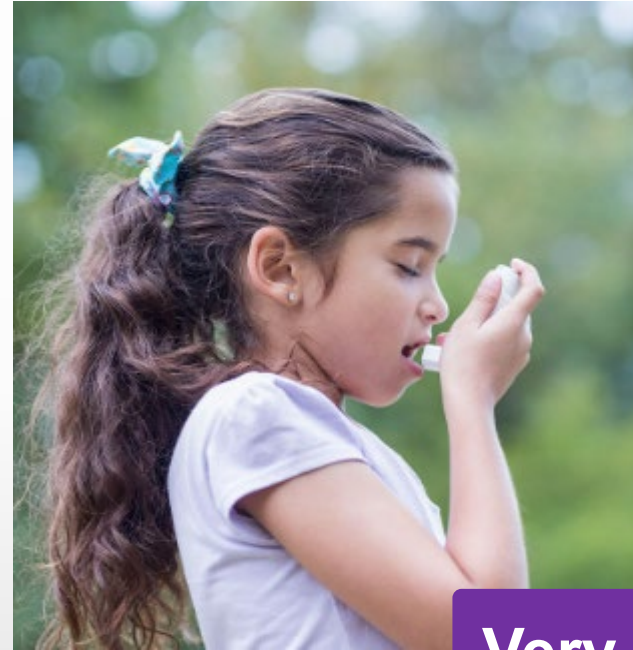
For some groups of people wildfire smoke is more dangerous!



# Sensitive and Very Sensitive People



**Sensitive**



**Very Sensitive**

Short Term Exposure (days to weeks) of Sensitive Groups may trigger:

- Asthma Attacks
- Irregular Heartbeat
- Heart Attack
- Stroke
- Preterm Labor
- Premature Birth



# Long Term Exposure to Wildfire Smoke

- Long Term Exposure:
  - When exposure goes on for months or years
- Leads to:
  - Reduced Lung Capacity
  - Chronic Bronchitis
  - Premature death\*

\*Studies have found air pollution shortens length of life by an average of 1.5 years in the USA\*.





# Wildfire Smoke and Heat Waves

- Two studies found that wildfire smoke combined with extreme heat is especially harmful
- Exposure to both was linked to an increased risk of death
- Increase risk of death mainly seen in people over 75 years old.
  - [Rahman et al. 2022](#)
  - [Novoselov, 2022](#)



What would you say?

There is a large wildfire 30 miles from your community. Local weather reports there is a strong possibility of heavy smoke in your area over the weekend.



Andrea is 7 months pregnant and plans to travel from Sacramento to visit your community for her niece's birthday party. She asks you, a community health representative, for advice on whether she should go or not.



Question: Think about the information we've covered so far. What do you advise her to do and why?



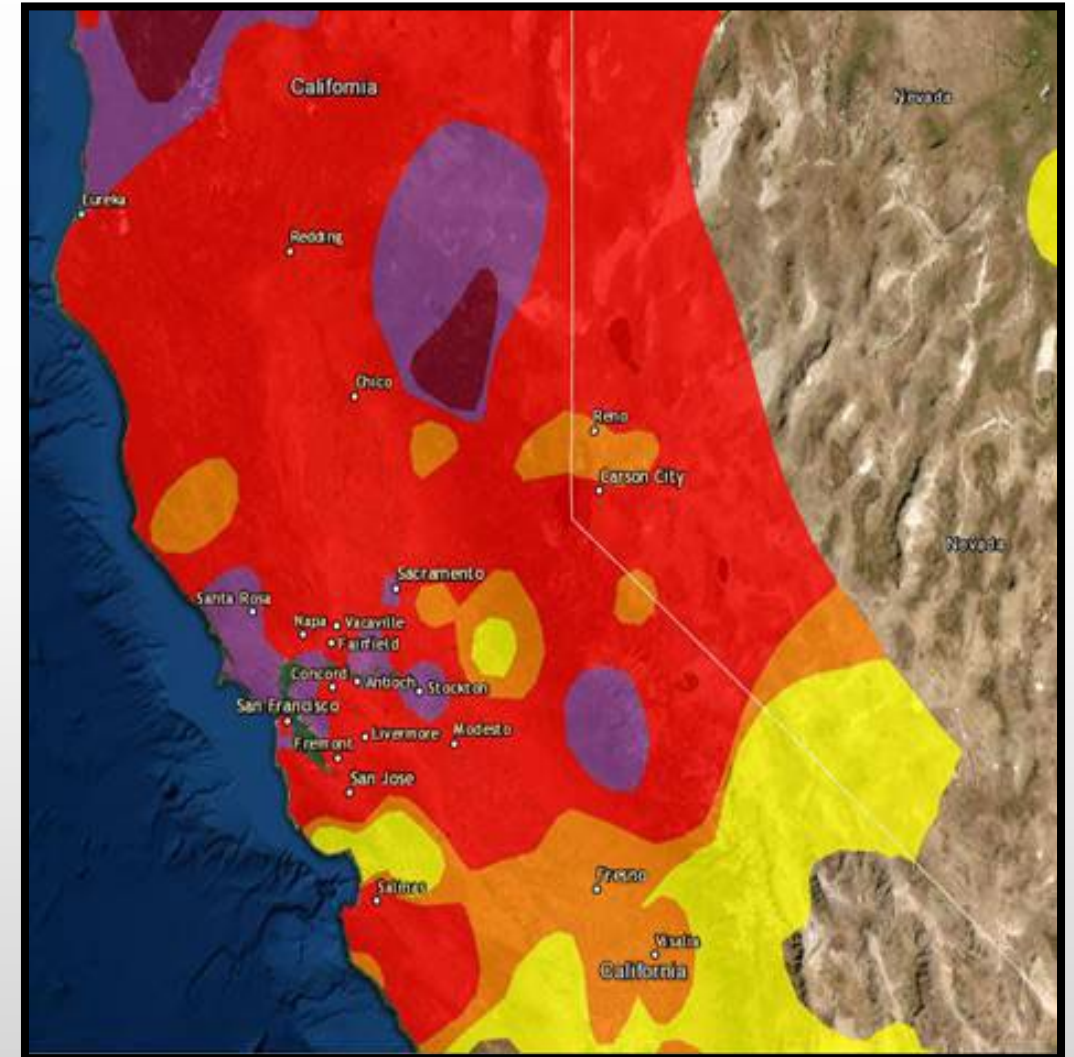


What to do when there is  
wildfire in your area?

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# First Step:

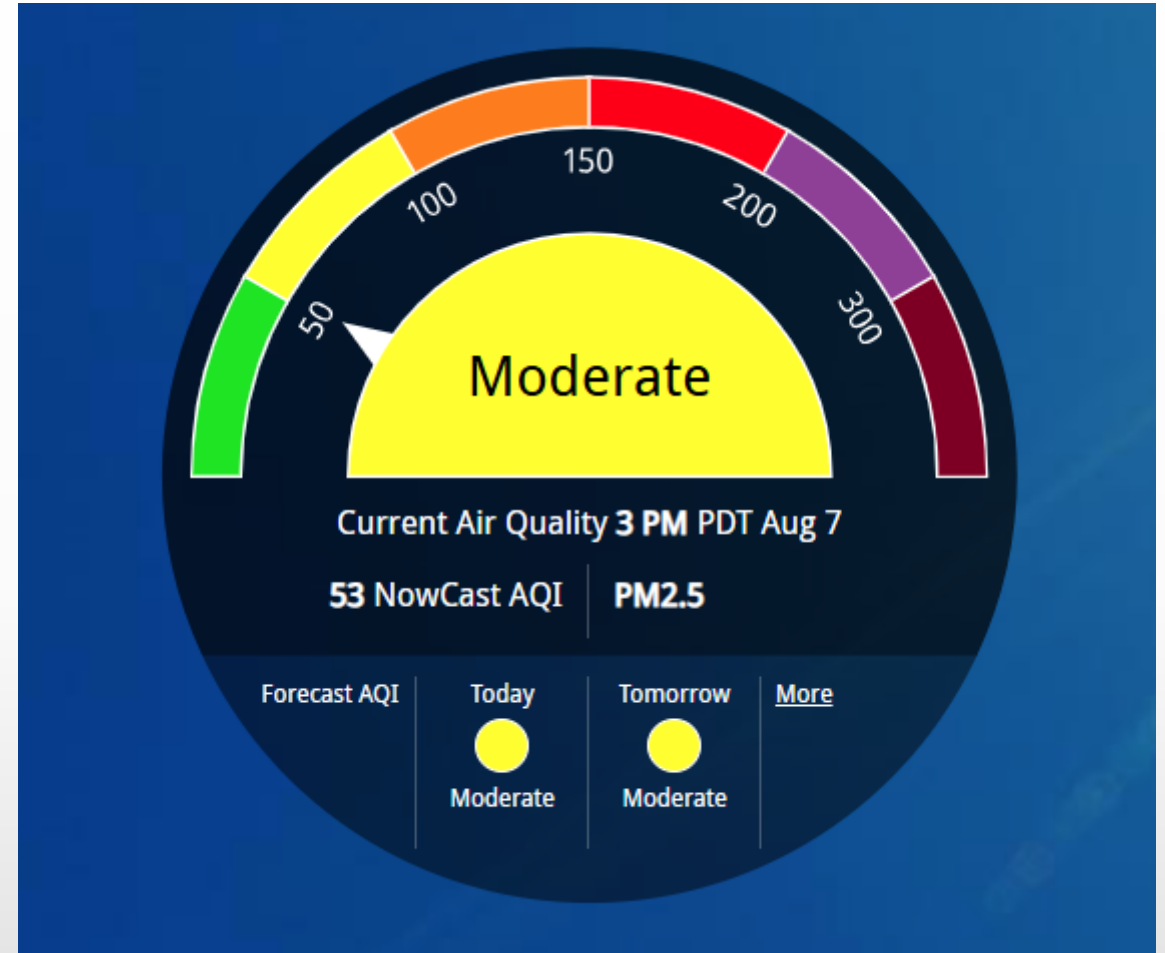
- Check the Air Quality Index for your area
- Sources for AQI information:
  - Local TV/Radio weather broadcast
  - Local Air Quality Management District
    - **Will have the most site-specific information for your area**
    - <https://ww2.arb.ca.gov/california-air-districts>
  - Visit [fire.airnow.gov](https://fire.airnow.gov)
    - Show most current PM 2.5 AQI levels.



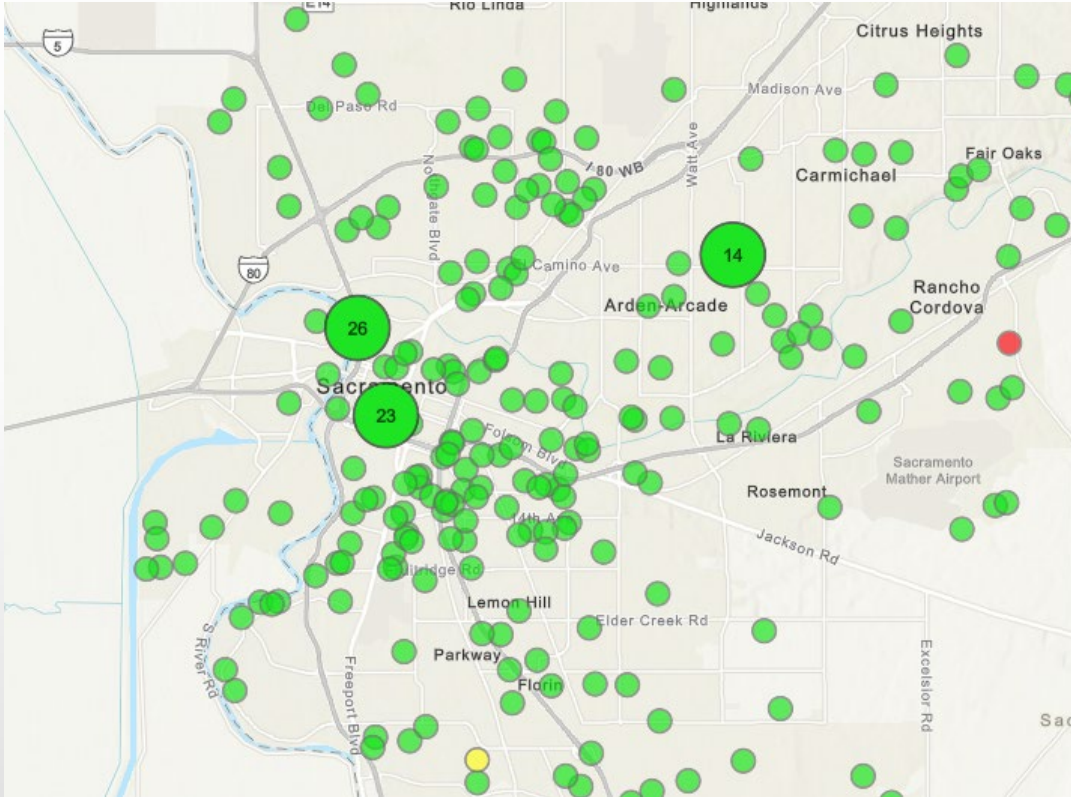
Northern California Air Quality per AirNow.gov 9/11/2020

# What does the Air Quality Index mean?

- AQI tells you how safe the air is to breath.
  - Index numbers are linked to the amount of PM 2.5 found in the air
- The higher the AQI number the greater the amount of wildfire smoke is in the air
- AQI also uses color to indicate how safe the air is
  - Color ranges from green to maroon



# Where does the AQI come from?



Air quality monitors in Sacramento Area

- Air quality monitors: there are hundreds across California
- Air quality monitors tell us how much PM 2.5 is in the air and how harmful the air is to breathe
- The air monitor nearest to you determines the AQI in your community

# Understanding AQI Color and Numbers

LEVELS OF CONCERN	AQI VALUES
Good	0 - 50
Moderate	51 - 100
Unhealthy for sensitive groups	101 - 150
Unhealthy	151 - 200
Very Unhealthy	201 - 300
Dangerous	301 - 500



# What does it mean when the AQI is green?



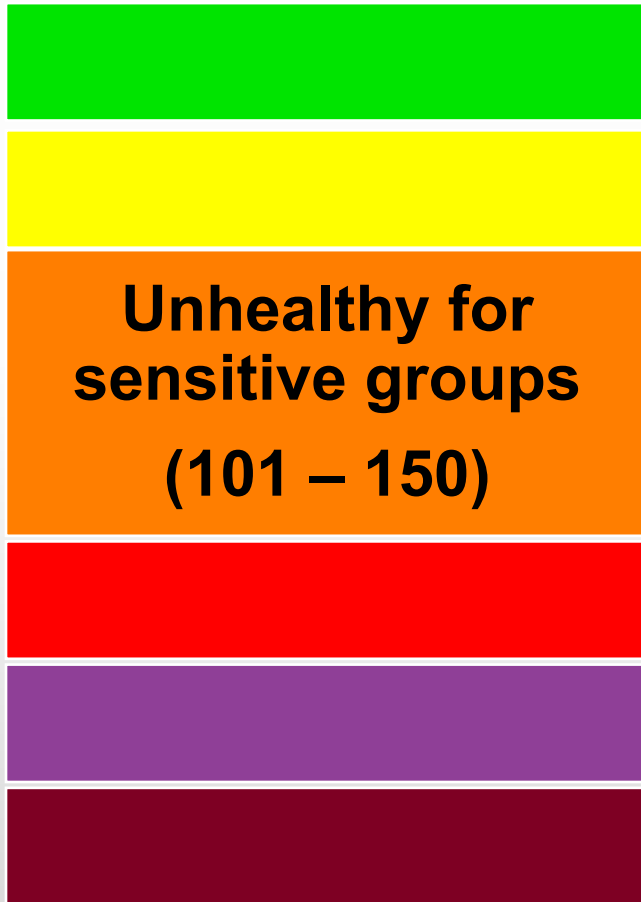
What does this mean?	Actions to take
Air quality is healthy for everyone	None. It's a great day to be outside.

# What does it mean when the AQI is yellow?

**Moderate (51-100)**

What does this mean?	Actions to take
Air quality can be harmful to <u>very sensitive</u> groups	Very sensitive groups should spend less time outdoors and avoid strenuous outdoor activities

# What does it mean when the AQI is orange?



What does this mean?	Actions to take
Air quality can be dangerous for <u>sensitive groups</u>	Sensitive groups should reduce outdoor activities, limit time outdoors and wear a mask

# What does it mean when the AQI is red?



What does this mean?	Actions to take
<u>Everyone</u> can experience some health problems	<ul style="list-style-type: none"><li>• Everyone should limit strenuous outdoor activities</li><li>• Everyone should limit time outdoors</li><li>• Wear a mask when outdoors</li><li>• Sensitive groups should stay inside a “clean room” at home</li><li>• Avoid vacuuming, burning candles, frying/broiling foods, gas range, aerosol sprays, fireplaces, wood burning stove</li><li>• Do not run window fans</li><li>• Set AC to recirculate in home and vehicle</li></ul>

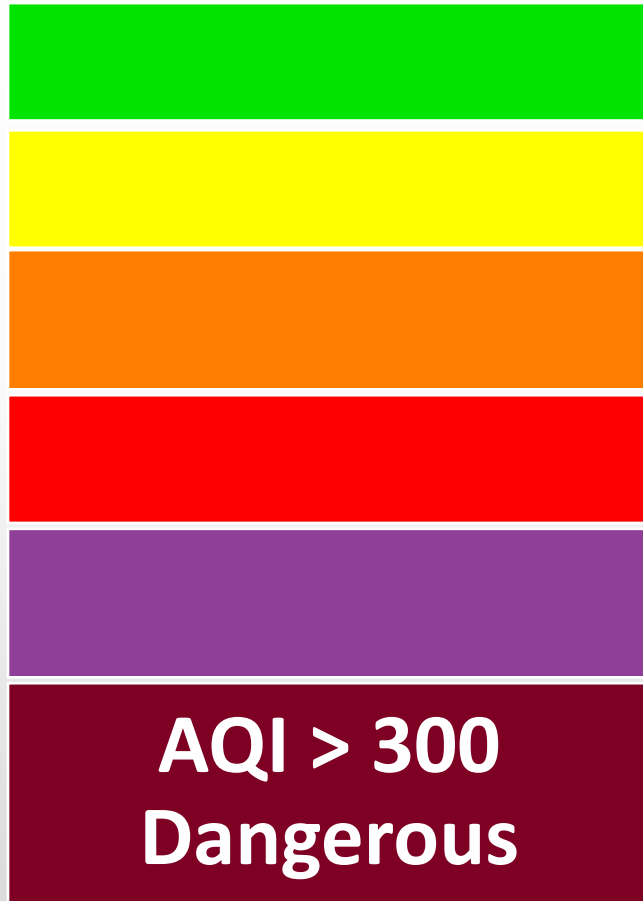
# What does it mean when the AQI is purple?



What does this mean?	Actions to take
The air is very unhealthy for everyone	<ul style="list-style-type: none"><li>• Everyone should avoid strenuous outdoor activity</li><li>• Stay indoors preferably in a space with filtered air</li><li>• Everyone should wear a mask when outdoors</li></ul>

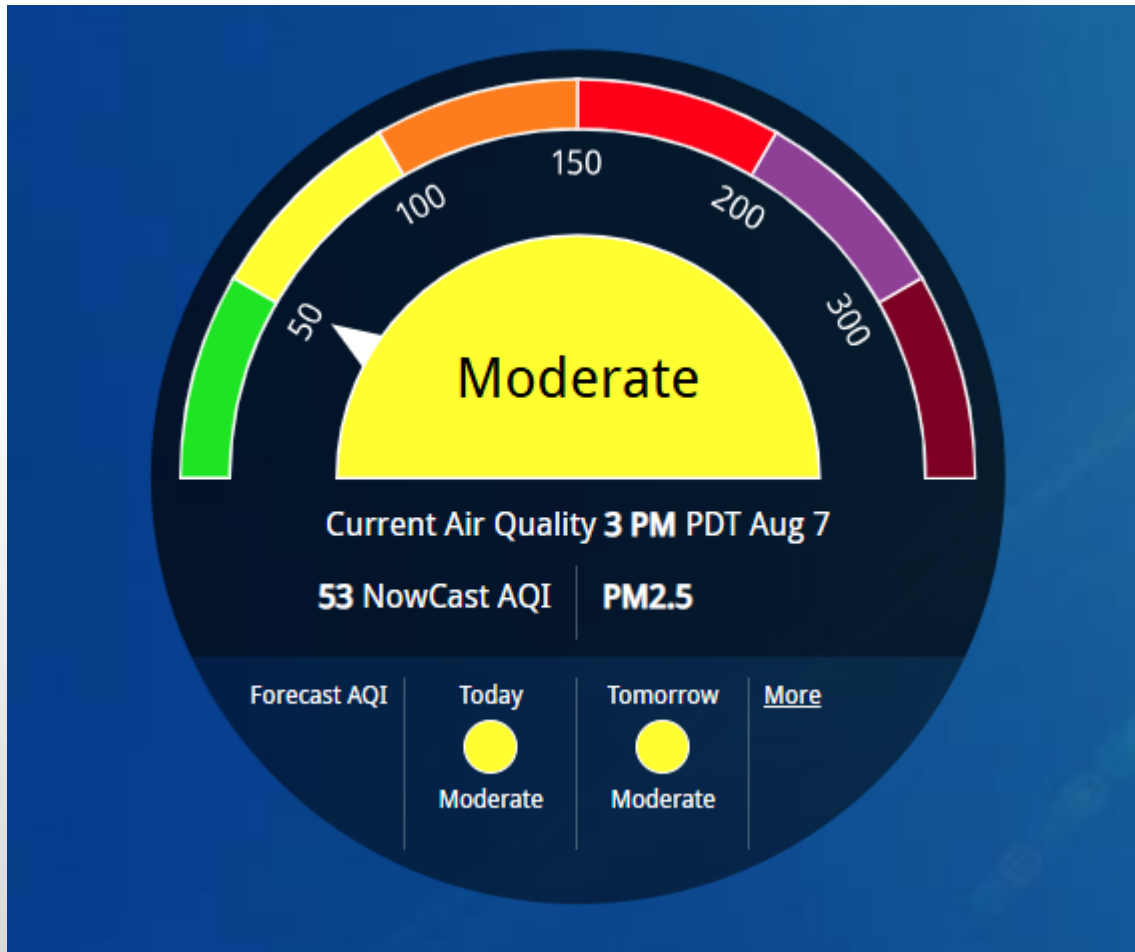


# What does it mean when the AQI is maroon?



What does this mean?	Actions to take
Air quality is dangerous for all groups	<ul style="list-style-type: none"><li>• Everyone should stay indoors</li><li>• Time outdoors is limited to essential activities</li><li>• Use a portable air</li><li>• If symptomatic seek medical attention.</li><li>• If you are unable to create a clean room in your home evacuate to a cleaner air shelter or leave the area</li></ul>

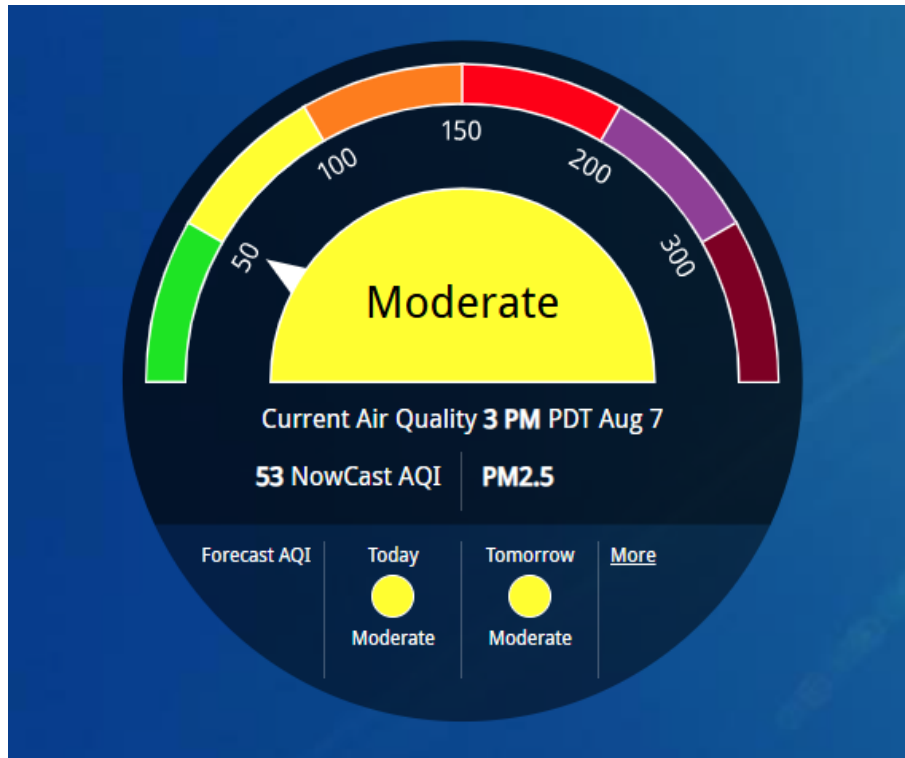
## Step 2: Act on the AQI



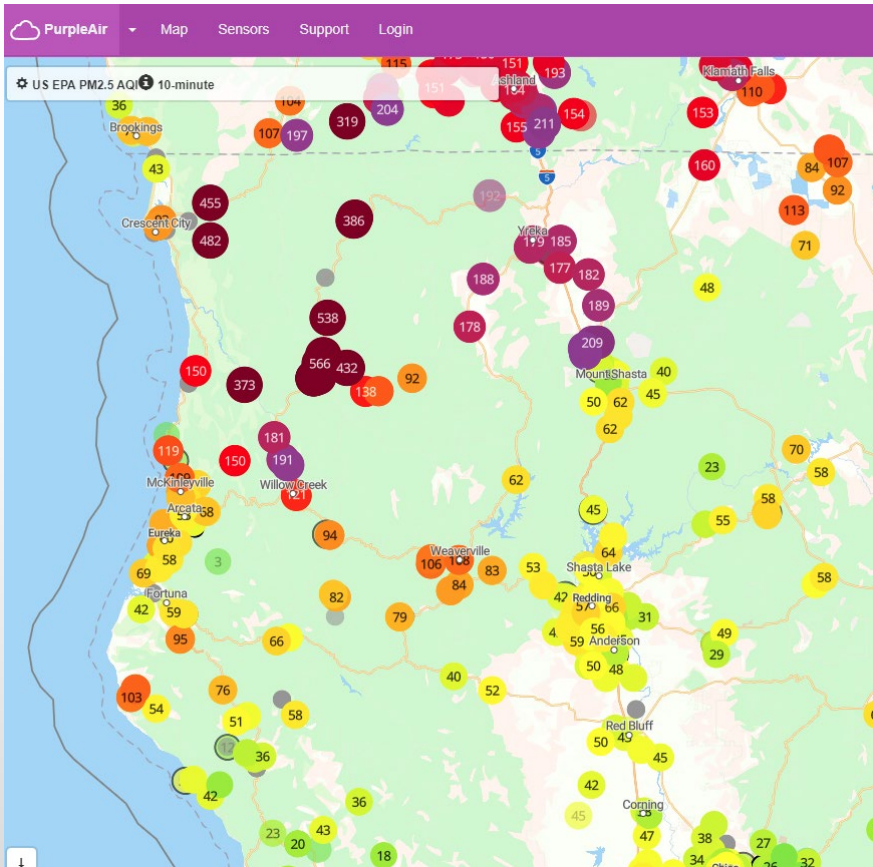
**Would you let your child play basketball outside today?**

# What if your child has asthma?

Does this change your decision?



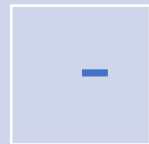
# Other Sources for AQI



PurpleAir.com



Purple Air is not accurate when readings are above 150 AQI.\*

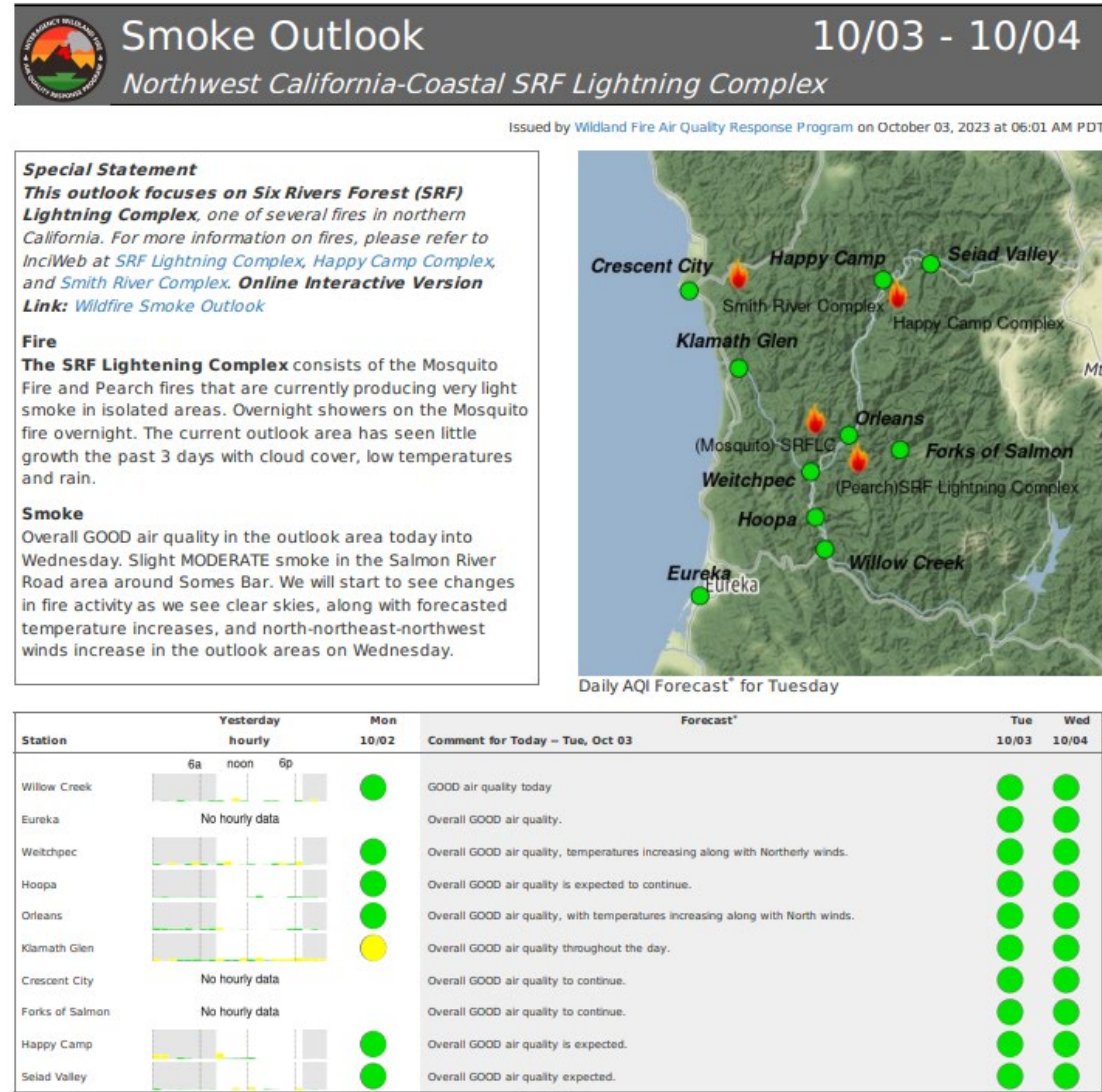


Recommend using [fire.airnow.gov](https://fire.airnow.gov) as it includes PurpleAir data, but the data is corrected for the instrument error.

\*Source: Barkjohn, Karoline et. Al. *Correction and Accuracy of PurpleAir PM2.5 Measurements For Extreme Wildfire Smoke*. *Sensors* **2022**, 22, 9669. <https://doi.org/10.3390/s22249669>

# Other Sources for AQI

- Interagency Wildland Fire Air Quality Response Program:
  - Has more specific smoke forecast information.
  - <https://outlooks.airfire.org/outlook>



Issued Oct 03, 2023 by Yancey Ranspot - Air Resource Advisor (ARA) yancey.d.ranspot@usda.gov



# Useful Phone App: California Smoke Spotter

- This App Offers:
  - 72-hour smoke forecasts.
  - Map of Fire Locations.
  - Will send you alerts for specific locations that you tag.
  - Helpful if you have family members in other locations or need to travel somewhere in CA.



The image displays three overlapping screenshots of the California Smoke Spotter app. The leftmost screenshot shows the 'AIR QUALITY INDEX (PM2.5)' with a value of 18, categorized as 'Good (0 - 50)'. It also displays the monitor type as 'Purple Air', the last update time as '11/07/2022 at 9:00am', and a recommendation to open windows or go outdoors. The middle screenshot shows a map of California with fire locations marked by orange dots and labels like 'The STONE wildfire 19 mi away'. The rightmost screenshot shows the 'SMOKE FORECAST' section, indicating 'Friday 8:00 AM PDT' and providing a 72-hour forecast for smoke from prescribed fires and wildfires. The app's logo, a white flame inside a blue location pin, is positioned to the right of the screenshots. Below the logo, the text 'California Smoke Spotter' is written in white. Further down, the text 'Helping Californians prepare for fire & smoke' is displayed. At the bottom right, there are two buttons: 'Download on the App Store' and 'GET IT ON Google Play'.

California Smoke Spotter

Helping Californians prepare for fire & smoke

Download on the App Store

GET IT ON Google Play

Prevent wildfire smoke  
exposure at home and at work

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# Step 3: Protect yourself at home



**If you see ash or  
smell smoke, your  
health is being  
harmed!**



**Keep smoke out of your  
home by:**

- Closing all windows and doors.
- Close the damper on your fireplace
- Using the recirculate mode on your air conditioning system
  - Prevents the AC from pulling outside air into your home.
- If using a window AC:
  - Close the outdoor air damper.
  - If you cannot, it is recommended to not use it

# Protect yourself at home

When smoke is present avoid adding pollutants to indoors

Avoid doing the following indoors:

- Smoking
- Using gas, propane, or wood burning stoves
- Spraying aerosols (like Febreze)
- Frying or broiling foods
- Vacuuming (disturbs dust)
- Burning candles, incense or sage

If you must go outside, wear an N95 respirator.

- If you are considered sensitive to wildfire smoke, talk to your doctor before wearing one.







## When Smoke and Excessive Heat are Present

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- If you do not have air conditioning in your home or it is too expensive to run it, have a plan to spend the hottest part of the day at a cooling center.
  - Possible public locations with air conditioning that can offer respite from the heat and smoke include:
    - Libraries,
    - Community Centers,
    - Public Indoor Swimming Pools,
    - Senior Centers,
    - Recreation Centers.



# When Smoke and Excessive Heat are Present

- Your Tribe may decide to open a Cooling Shelter.
  - Cooling Shelters offer:
    - Air Conditioning,
    - Water,
    - Food,
    - Support Services such as:
      - Transportation,
      - Medical/first aid,
      - Electronics charging.



# Step 4: Wildfire Smoke Workplace Guidance

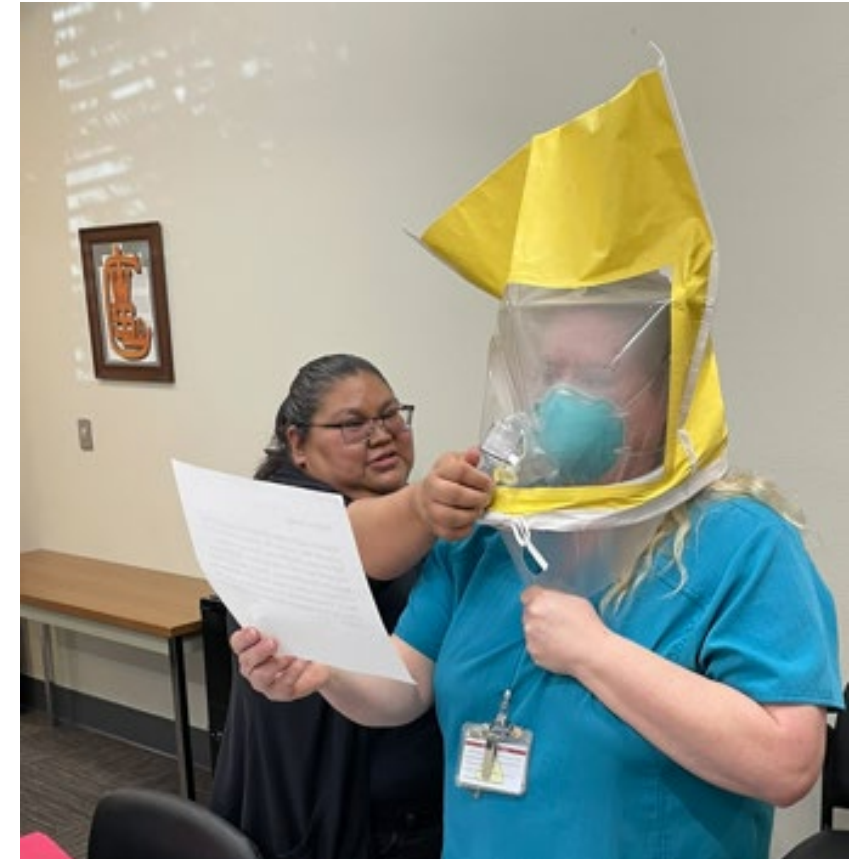
- Cal OSHA has rules for workers working outdoors when wildfire smoke is present
  - Supervisors are to monitor AQI during wildfire season
  - When AQI > 150 (Unhealthy):
    - Outdoor work should be limited
    - Ensure exposure does not exceed 1 hour (cumulative) per day
    - Voluntary use of N95 by workers
      - Users need to sign voluntary use agreement per OSHA Respiratory Standard
      - Supervisors are to encourage their use

# When the AQI is Dangerous:

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**Respiratory protection is required per Cal OSHA if AQI > 500  
(Dangerous)**

- User must be part of Respiratory Protection Plan if mandated to wear a respirator
  - Have a physician complete a medical evaluation
  - Respiratory Hazard Analysis must be completed
    - ID work task, exposure hazard, type PPE assigned
  - User must be fit tested for the N95 (by brand/model) they are provided
  - All documentation must be filed with the Safety Officer



# How to prepare for wildfire smoke

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# Prepare for Wildfire Smoke

## 1. Have a Plan

- Sensitive Groups:
  - Plan to leave the area or stay with a friend/relative during **Dangerous** AQI levels.
  - Know ahead of wildfire season where cleaner air facilities will be in your community.
    - Your Tribal Health Program or Tribal Office of Emergency Services will be able to tell you the usual locations.
- Keep a supply of your medications that will last at least 7 days in case you need to evacuate or stay at a shelter.



Asthma Action Plan for Home and School



AMERICAN  
LUNG  
ASSOCIATION

Name \_\_\_\_\_ DOB \_\_\_\_/\_\_\_\_/\_\_\_\_.

Severity Classification ☐ Intermittent ☐ Mild Persistent ☐ Moderate Persistent ☐ Severe Persistent

Asthma Triggers (list) \_\_\_\_\_

Peak Flow Meter Personal Best \_\_\_\_\_

Green Zone: Doing Well

Symptoms: Breathing is good – No cough or wheeze – Can work and play – Sleeps well at night

Peak Flow Meter \_\_\_\_\_ (more than 80% of personal best)

Control Medicine(s)	Medicine	How much to take	When and how often to take it	Take at
	_____	_____	_____	<input type="checkbox"/> Home
	_____	_____	_____	<input type="checkbox"/> Home

Physical Activity ☐ Use albuterol/levalbuterol \_\_\_\_\_ puffs, 15 minutes before activity ☐ with all activity ☐ when the child feels he/s

Yellow Zone: Caution

Symptoms: Some problems breathing – Cough, wheeze, or chest tight – Problems working or playing – Wake at night

Peak Flow Meter \_\_\_\_\_ to \_\_\_\_\_ (between 50% and 79% of personal best)

Quick-relief Medicine(s) ☐ Albuterol/levalbuterol \_\_\_\_\_ puffs, every 4 hours as needed

Control Medicine(s) ☐ Continue Green Zone medicines

☐ Add \_\_\_\_\_ ☐ Change to \_\_\_\_\_

The child should feel better within 20–60 minutes of the quick-relief treatment. If the child is getting worse or is in the Yellow Zone for more than 24 hours, THEN follow the instructions in the RED ZONE and call the doctor right away!

Red Zone: Get Help Now!

Symptoms: Lots of problems breathing – Cannot work or play – Getting worse instead of better – Medicine is not helping

Peak Flow Meter \_\_\_\_\_ (less than 50% of personal best)

Take Quick-relief Medicine NOW! ☐ Albuterol/levalbuterol \_\_\_\_\_ puffs, \_\_\_\_\_ (how frequently)

Call 911 immediately if the following danger signs are present

- Trouble walking/talking due to shortness of breath
- Lips or fingernails are blue
- Still in the red zone after 15 minutes

School Staff: Follow the Yellow and Red Zone instructions for the quick-relief medicines according to asthma symptoms.

The only control medicines to be administered in the school are those listed in the Green Zone with a check mark next to "Take at School".

☐ Both the Healthcare Provider and the Parent/Guardian feel that the child has demonstrated the skills to carry and self-administer their quick-relief inhaler, including when to tell an adult if symptoms do not improve after taking the medicine.

Healthcare Provider

Name \_\_\_\_\_ Date \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_-\_\_\_\_-\_\_\_\_ Signature \_\_\_\_\_

Parent/Guardian

☐ I give permission for the medicines listed in the action plan to be administered in school by the nurse or other school staff as appropriate.

☐ I consent to communication between the prescribing health care provider or clinic, the school nurse, the school medical advisor and school-based health clinic providers necessary for asthma management and administration of this medicine.

Name \_\_\_\_\_ Date \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_-\_\_\_\_-\_\_\_\_ Signature \_\_\_\_\_

School Nurse

☐ The student has demonstrated the skills to carry and self-administer their quick-relief inhaler, including when to tell an adult if symptoms do not improve after taking the medicine.

Name \_\_\_\_\_ Date \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_-\_\_\_\_-\_\_\_\_ Signature \_\_\_\_\_

1-800-LUNGUSA | LUNG.org

Please send a signed copy back to the provider listed below.

# If You Have Asthma

- Work with your healthcare provider and prepare an [Asthma Action Plan](#).
- Keep a 7-10 day supply of medication in a waterproof container.



# Preparing for Wildfire Smoke

## 2. Keep a supply of N-95 Respirators.

- Ensure they are NIOSH approved.
- Keep at least one box of 20 respirators/person for fire season.
  - N95s should not be placed on children as they will not produce a proper fit.
- If you have lung or heart disease talk to your doctor before wearing an N-95 respirator.
  - N-95s make breathing more difficult due to the air having to pass through a filter.
- N95 respirators can be reused during a smoke event.
  - Discard when soiled or damaged.



\*The Indian Health Service does not endorse these brands or their products, these are just examples\*

# Not all Masks are Appropriate

Dust masks (paper masks) or masks with one strap or two straps that loop around the ear will not protect you from PM2.5.

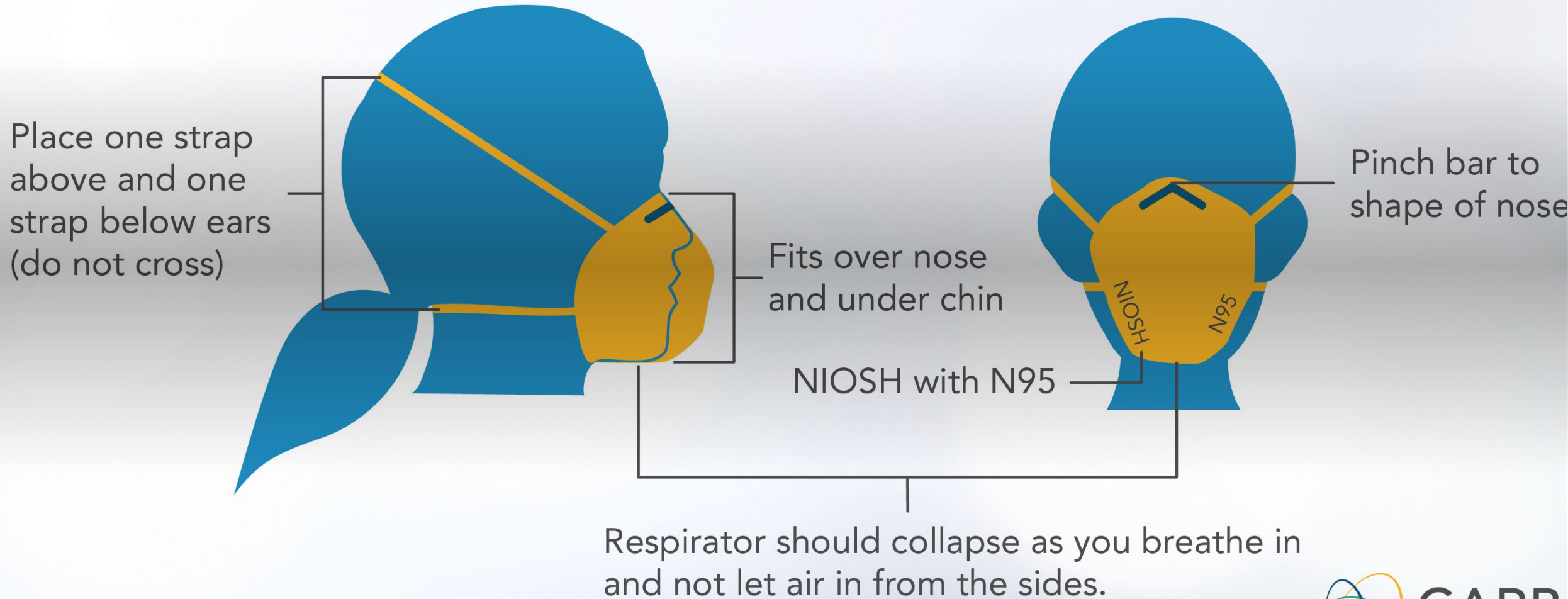
- Will not produce a snug fit or do not have needed filtering capabilities.

N95 respirator should have 2 straps that go around the head for a proper fit



# Wear N95 Masks Correctly

Use **N95** respirator masks marked **NIOSH** for the best protection against smoke



# Prepare for Wildfire Smoke

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## 3. Use a portable HEPA Air Purifier.

- Should be CARB certified.
  - [CARB Certified Air Cleaning Devices List](#)
  - CARB certification shows that the air purifier meets California's electrical safety and ozone emission standards.
- The advertised square footage should meet or exceed the size of the intended room.
  - Size an air purifier using equation or CADR
- Should maintain a supply of filters and change them according to manufacturer's instructions.

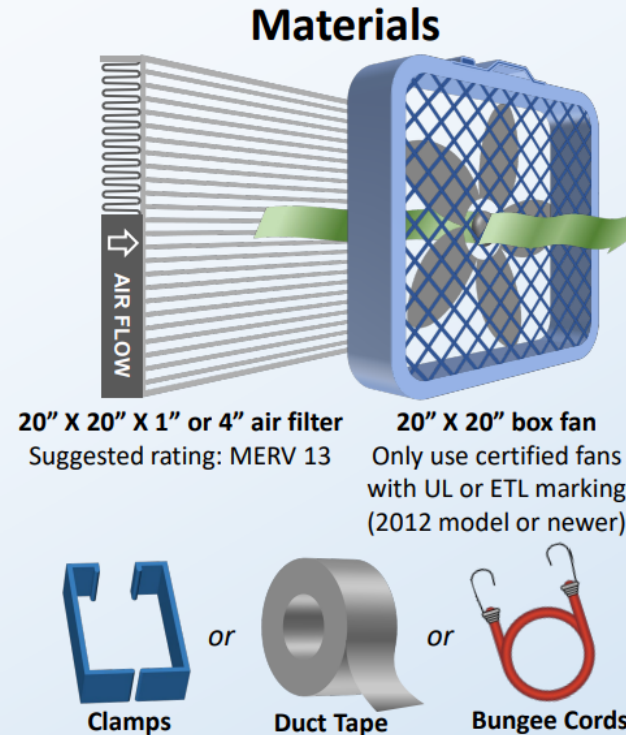




# DIY Air Cleaner

If you do not have access to a commercial portable HEPA Air Purifier, you can DIY one.

## DIY Air Cleaner to Reduce Wildfire Smoke Indoors: Basic Design



### Assembly

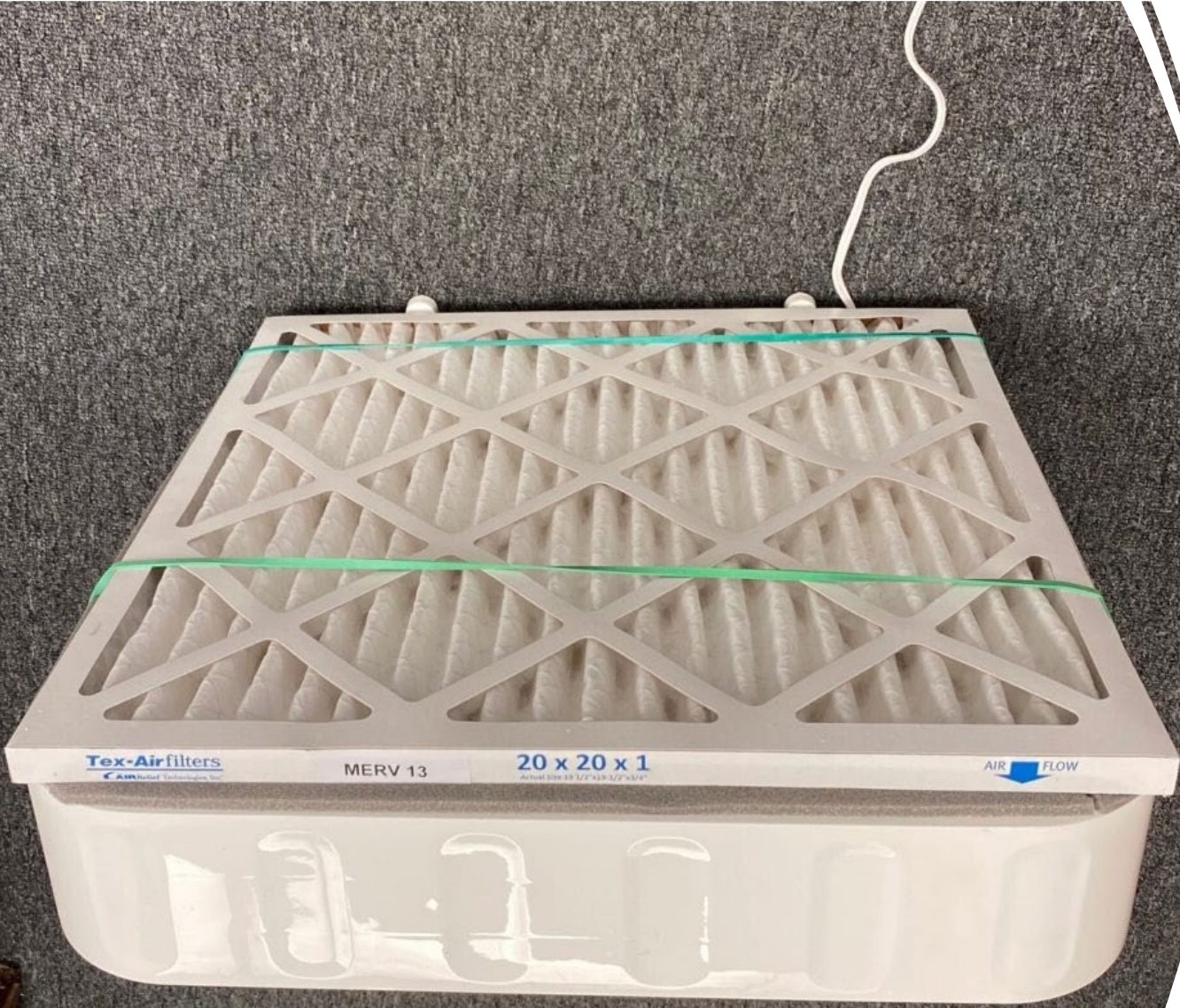
1. Attach the air filter to the back of the box fan using either clamps, duct tape or bungee cords.
2. Check the filter for the direction of the air flow (marked on the side of the filter).
3. Replace filters when dirty.

Learn about box fan safety tips:

<https://www.epa.gov/air-research/research-diy-air-cleaners-reduce-wildfire-smoke-indoors#FAQ>

# DIY Air Cleaner

- Use a UL or ETL approved box fan that is a 2012 or newer model.
- Fans modeled prior to 2012 don't have new safety features that prevent the motor from overheating and may pose fire risk.
- Have extra MERV 13 filters on hand.
- During heavy smoke, they may need to be changed every few days.
- Useful for small rooms, such as bedrooms.





# 3 minute video: How to make a HEPA air purifier

- [DIY Filter/Fan Combo - Climate Smart Missoula - YouTube](#)

# MERV



## Prepare for Wildfire Smoke

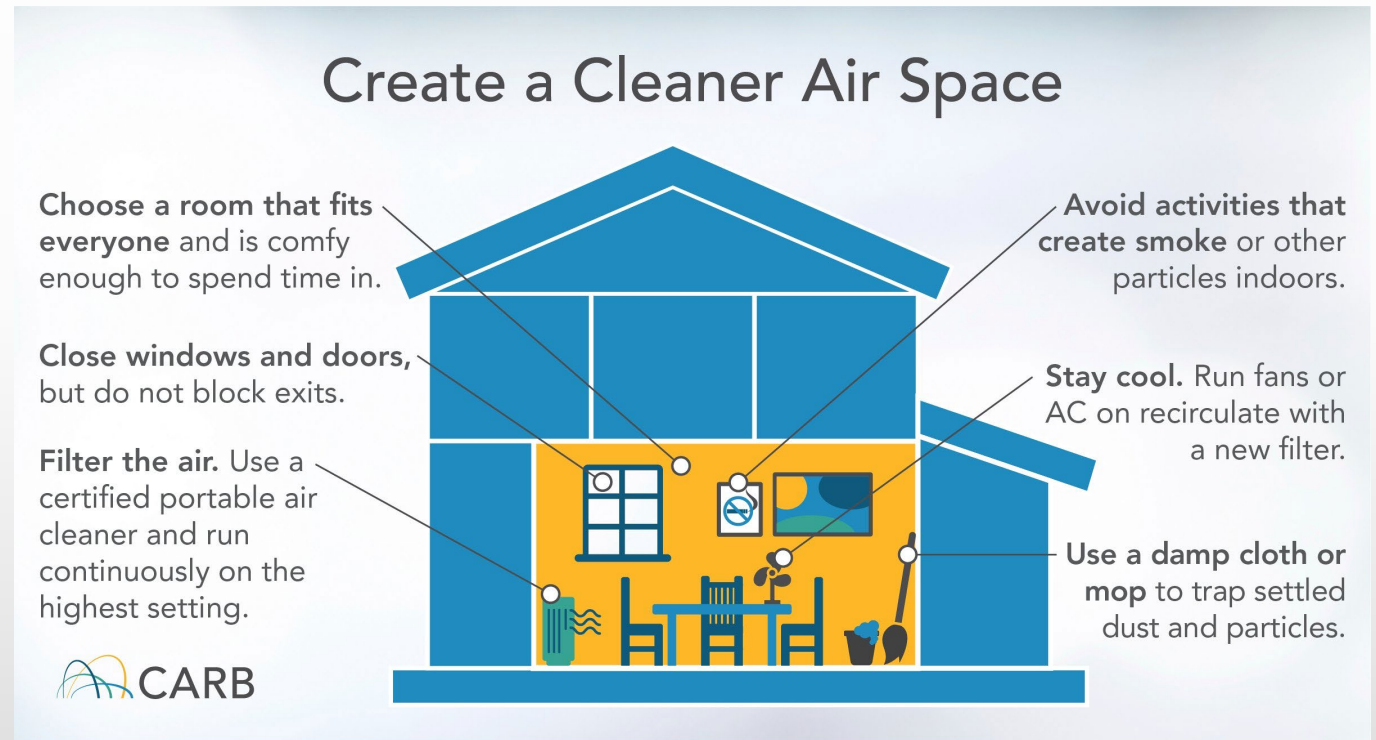
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4. **Install a MERV 13 filter if your A/C system can handle it.**
  - Higher rating filters may overload system, so check manufacturer's recommendations before using a MERV 13 filter in your home's air conditioning system.
  - Change filters frequently during a smoke event. Filters will load quickly.
  
5. **Assess your home and ensure it is weatherized.**
  - Seal any intrusion points around doors and windows with caulk and weather stripping.

# Prepare for Wildfire Smoke

## 6. Plan to Have a Clean Air Room in your home:

- Especially if you cannot keep smoke out of the home;
- Choose a room with well sealed doors and windows and preferably with an attached bathroom;
- Outfit room with a portable HEPA air purifier that is sized for the square footage of the room;
- Use A/C or fans to cool the air, do not use evaporative coolers (a.k.a. “swamp coolers”) as they pull unfiltered outside air into the home.



Source: <https://www.epa.gov/indoor-air-quality-iaq/create-clean-room-protect-indoor-air-quality-during-wildfire>

# References

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- [Minnesota Department of Health: Wildfire Smoke and Health](#)
- [UC Davis Environmental Health Sciences Center: Environmental Health Impacts of Wildfire](#)
- [Journal of Thoracic Disease: The impact of PM2.5 on the human respiratory system](#)
- [US EPA Brochure: Particle Pollution and Your Health](#)
- [US EPA: How does PM affect human health?](#)
- [US Forest Service Flyer: Wildfire Smoke and Your Health](#)

# References

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- [CDC: Private Wells after a Wildfire](#)
- [USGS California Water Science Center: Water Quality after a Wildfire](#)
- [Journal of Environmental Health: Synergistic Health Effects of Air Pollution, Temperature and Pollen Exposure](#)
- [The Lancet Planetary Health: Heatwaves and wildfires suffocate our health start to life](#)
- [American Journal Respiratory Critical Care Medicine: Heatwaves and Air Pollution—a Deadly Combination](#)
- [UCLA Newsroom: Dangerous combination of extreme heat and smoke affected 16.5 million Californians](#)

# References

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- [US EPA Flyer: Wildfire Smoke Factsheet](#)
- [CDC: Wildfire Smoke and People with Chronic Conditions](#)
- [US EPA: Which Populations Experience Greater Risks of Adverse Health Effects Resulting from Wildfire Smoke Exposure?](#)
- [New York State Department of Health: Exposure to Smoke from Fires](#)
- [Clark County Washington Public Health: Smoke from Wildfires](#)
- [International Journal of Environmental Research and Public Health: Wildfire Smoke Exposure During Pregnancy](#)
- [USEPA WILDFIRE SMOKE: A GUIDE FOR PUBLIC HEALTH OFFICIALS](#)