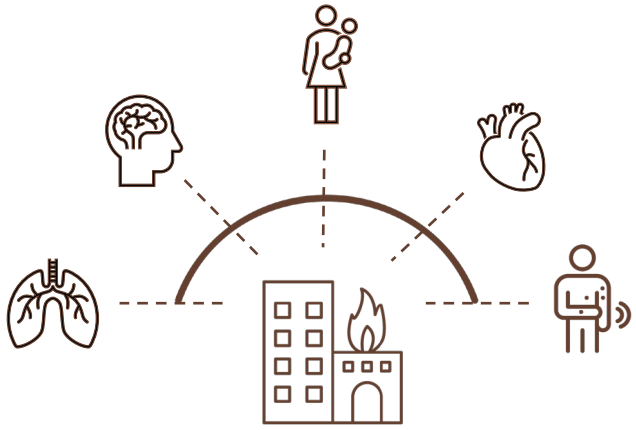


Health Impacts of Wildfires in Urban Areas

Booklet A

from the *Understanding Health Impacts of Wildfires in Urban Areas* series

Other booklets in this series:

A. Health Impacts of Wildfires in Urban Areas
B. During the Fire: Smoke, Air Quality, and Protecting Yourself
C. After the Fire: Lead and other Fire Contaminants in and around your Home
D. Mental Health and Wildfires
E. Further Reading

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Series Note: This series addresses some of the health concerns from wildfires that reach urban areas. These fires are also called Wildland-Urban Interface (WUI) fires. Since the general public may not use the term WUI, we use "wildfires that reach urban areas" or, more briefly, "fires" to refer to large, catastrophic fires that may also burn buildings, cars, and other non-natural sources.

Key point!



Look for these "Key points" throughout this handout for the most important summaries.

Quick Overview:

Health Impacts of Wildfires that Reach Urban Areas

What you need to know to protect yourself!

How does smoke from large fires harm health?

- **Wildfire smoke can cause health issues**:
  - Irritation in your eyes, nose, and throat
  - Coughing and trouble breathing
  - Harm to your lungs, heart, brain, and mental health
  - Note: These health risks worsen during hot weather.
- **When wildfires reach urban areas and burn homes, cars, and chemicals, the smoke becomes much more toxic** than smoke from burning forests alone.
- **Even if you're far from the fire, smoke can travel long distances and make the air unsafe to breathe.**
- **Smoke is the biggest health risk for most people and reducing smoke exposure is the best thing you can do for your health.** Reducing contact with contaminated ash, soot, dust, or water is also important.

Who is at risk of health impacts from smoke?

- **Certain groups are more sensitive to health problems from smoke.** These include infants and youth, pregnant people, people with disabilities or chronic health conditions, older adults, those at higher risk of exposure (like outdoor workers), populations with limited resources, and racial and ethnic minorities.

What can I do to protect myself and others?

- **Leaving the area temporarily is the best way to protect yourself from smoke**. If traveling isn't an option, stay inside, keep all doors and windows shut, and use air purifiers. Stay informed on evacuation notices. If you need to go outside, wear a tight-fitting mask and ideally a respirator (an N95 or P100). It is best to have professionals conduct post-fire cleaning, but if you must, use appropriate personal protective equipment (PPE) when cleaning up ash or moving debris after the fire.

Wildfire smoke is unhealthy. But it's even worse when fires reach urban areas!

When wildfires reach urban areas and burn buildings, homes, cars, and chemicals, the smoke contains many more contaminants than smoke from burning forests alone. These are often called Wildland-Urban Interface (WUI) fires.

Any exposure to fire smoke can affect your health (see page 5).

Unhealthy smoke to breathe	→	Even more unhealthy smoke to breathe
	→	
Wildfires that burn forests, trees, plants, and other natural materials. Even when natural materials burn, the smoke contains toxic contaminants, which are unhealthy to breathe.	→	**Wildfires that reach urban areas** burn buildings, homes, appliances, cars, batteries, and the metals, paints, plastics, and chemicals inside them. There are a large number of toxic contaminants in this smoke, making it very unhealthy to breathe.

Key point!

Minimize smoke exposure to protect your health during all fires, but especially during urban fires.

What are the health effects of fire smoke?

Smoke can affect many parts of the body, not just the lungs, and can worsen pre-existing conditions. These health risks can worsen during hot weather.



Respiratory impacts

- Coughing, trouble breathing, wheezing, burning throat, shortness of breath, bronchitis, irritated sinuses, runny nose, and red/stinging eyes.
- May lead to reduced lung function, increased asthma attacks, and worsen or increase the risk of lung diseases*



Mental/Brain health

- Anxiety*, depression*, mental health conditions*
- Headaches, dizziness



Pregnancy & Birth Outcomes

- Early birth (preterm birth)*, low birth weight*



Cardiovascular risk

- Heart attack, stroke, heart disease*, or increases in blood pressure, heart palpitations, or chest pain.



Direct fire damage

- Burns, injuries, death



Other potential impacts (more research is needed)

- Cancer*, eye disease*, diabetes*, educational delays in children*
- Dermatitis/skin reactions, itching/irritation
- Nausea, unusual tiredness/fatigue
- Other brain impacts: dementia*, Alzheimer's*, brain fog

***Short-term vs. long-term health risks**: Health effects with asterisks* may take longer to appear (e.g., weeks, months, or years after the fire) or may occur more often with repeated wildfire smoke exposure over time.

What can I do if I am worried about my health? Report any new, persistent, or worsening symptoms to your doctor, especially if you have other health conditions or have had severe exposures.

Who is most at risk?

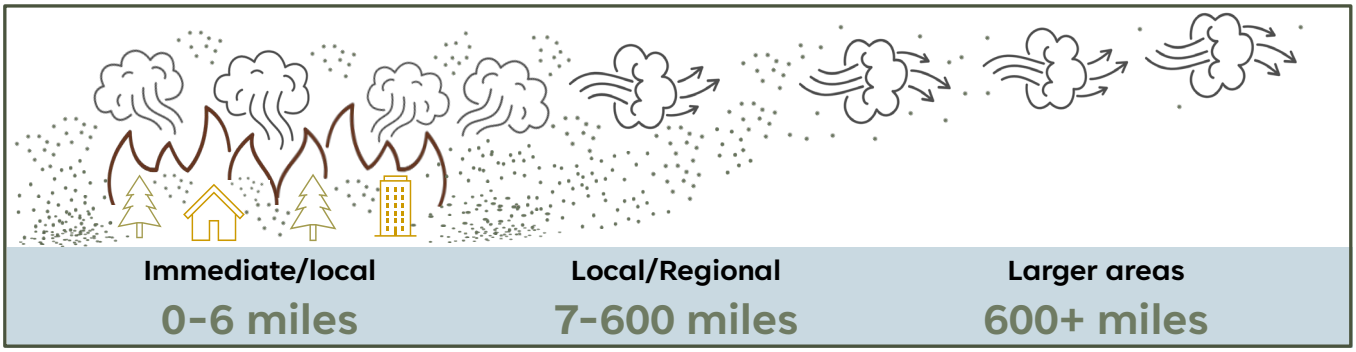
Certain groups are more likely to face health issues from smoke exposure.

- **Youth** with developing lungs (under 25 years of age).
- **Pregnant People**
- **People with Health Conditions:** disabilities, chronic diseases, or weakened immunity.
- **Older adults**
- **Workers**: Firefighters, first responders, outdoor and clean-up workers with high exposures.
- **People with Limited Resources**: Facing barriers related to housing, transportation, health coverage, health access, language access, or air filtration.
- **Racial and Ethnic Minorities**: Disproportionately impacted by systemic barriers, higher exposures to air pollution, and existing health inequities.
- **People in several of these groups** may face even greater health risks.

Modified from: Gould CF, et al. Health effects of wildfire smoke exposure. Annual Review of Medicine. 2024 Jan 29;75(1):277-92. https://doi.org/10.1146/annurev-med-052422-020909
With data from: (1) Ma Y, et al. Long-term exposure to wildland fire smoke $PM_{2.5}$ and mortality in the contiguous United States. *Proc Natl Acad Sci U S A.* 2024 (2) Lei Y, et al. Wildfire Smoke: Health Effects, Mechanisms, and Mitigation. Environmental Science & Technology. 2024 Nov 8;58(48):21097-119. (3) Ebinger et al. Emergency Encounters for Illness During and After the Los Angeles Wildfires. JACC. 2025 Dec 17. (4) Hubbard C, Abashidze N, Hennighausen H, James A. Catastrophic Wildfires & Suicide. Environmental and Resource Economics. 2026 Jul;89(7):48.

Smoke is the biggest health risk and the primary exposure for most people

Smoke is the most common way that people are exposed to toxic contaminants from large fires. Smoke can travel far from the fire, affect many communities, and expose people to harmful fire contaminants. Breathing smoke is the easiest way for these contaminants to enter your body and pose health risks.



After the smoke clears, it can also leave toxic ash and soot behind. Here are all the ways you may be exposed to fire contaminants (routes of exposure):

Breathing in (inhalation)
active smoke or disturbed dust/ash (i.e., from wind, dusting, cleaning, or construction).

Skin or eye contact
with settled dust or ash.
If the water supply is affected, bathing.

Incidental ingestion (accidentally swallowing)
of settled dust or ash from food, or touching your mouth with unwashed hands after handling contaminated dust, ash, or soil. If the water supply is affected, drinking, showering, or cooking with the water.

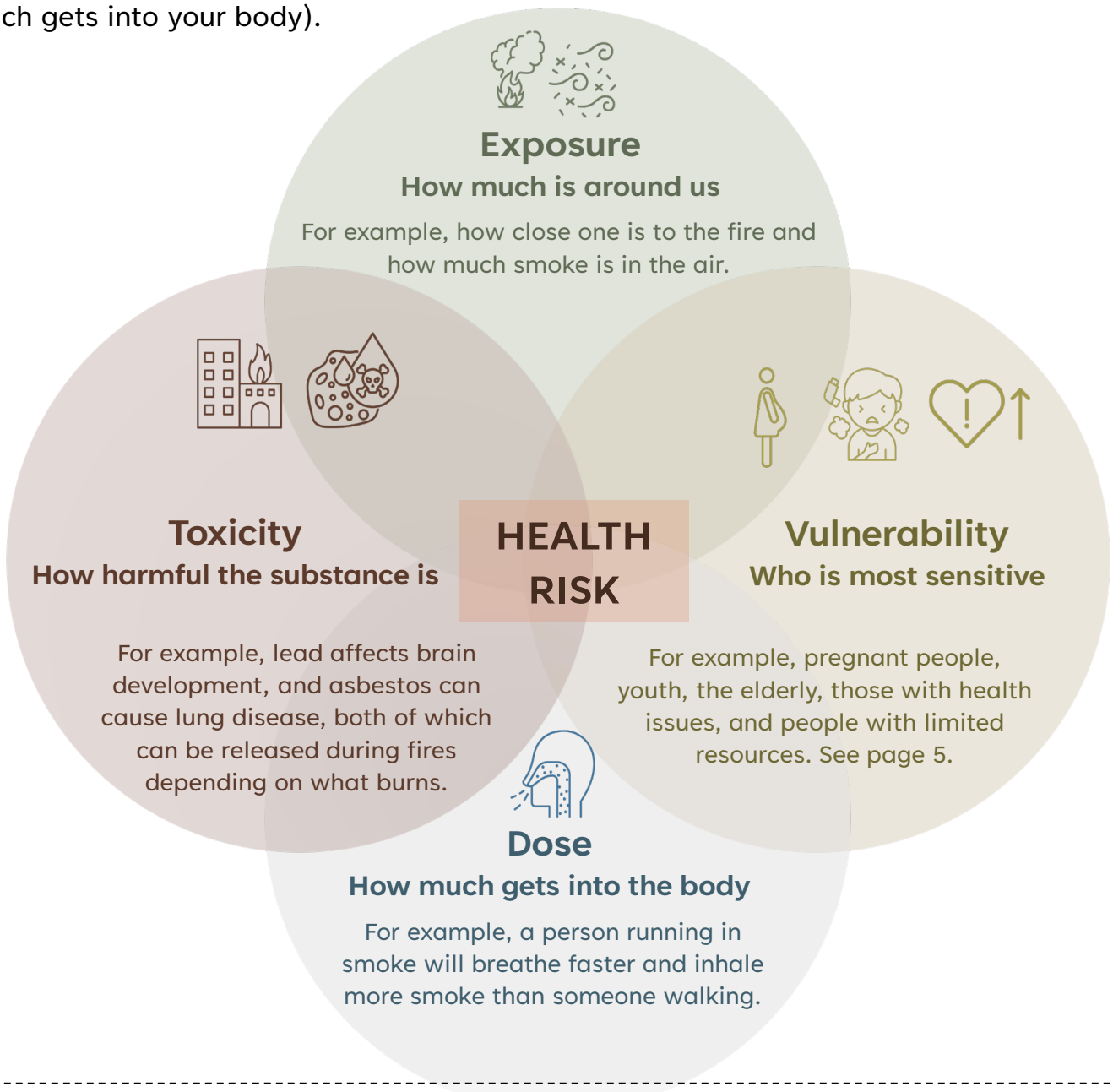
Key point!

For most people, breathing in active fire smoke is the biggest health concern and exposure. Other types of exposure may matter more for some people with higher exposure to fire debris or dust, for example, those near burn zones, cleanup workers, firefighters, children playing directly with contaminated materials, and people with certain water sources.

Figure adapted from (1) National Academies of Sciences, Engineering, and Medicine 2022. The Chemistry of Fires at the Wildland-Urban Interface. Washington, DC: The National Academies Press, and (2) TECHNICAL BRIEF When the Dust Settles: Reducing Chemical and Particle Health Risks Following a Large-Scale Urban Fire, UL Research Institutes, 2023.

What is my health risk from fires? How do we assess contaminant exposure?

Your total health risk from smoke and fire contaminants depends on four main factors, including: **Exposure** (how much is in the air or environment), **Toxicity** (how harmful the contaminant is), **Vulnerability** (how sensitive one may be to the harm), and **Dose** (how much gets into your body).



Examples of people who may have a higher risk of health impacts:

- An outdoor worker who is doing intensive physical labor near active fire smoke (**high exposure**), ends up breathing in heavy metals from nearby burned structures (**high dose** from higher breathing rate and **high toxicity** from the heavy metals), and who suffers from chronic coughing and bronchitis (**more vulnerability**).
- An older resident living directly downwind of a large fire that burned industrial warehouses (**high exposure**), where indoor air accumulates smoke (**high toxicity**), and who has a heart condition (**more vulnerability**).

Reducing exposure to smoke reduces your health risks

LEVELS OF PROTECTION

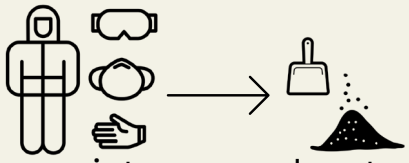
Reduce by:	Ways to reduce smoke exposure:	Advantages	Disadvantages
Up to 100%!	**Evacuation or relocation**	• The best way to protect your lungs from inhaling smoke is to avoid or limit exposure.	• May not be an option for those who are unable to leave for various reasons. • May add costs, stress, or leave from work or school. • Unknown timeframe. • Smoke can still travel far.
~75% (50-90%)	**Staying indoors with air purifiers**	• Reduces overall smoke exposure and is relatively, cost-effective. • Close doors and windows and other vents or gaps that can let in smoky air. • Works best with airtight homes.	• Homes may not be airtight and can still let in smoke. • Air conditioning or heating units can bring in smoke if not equipped with proper HEPA filters that are routinely maintained. If you don't have filters (including most window units), turn the unit off or switch to recirculate. This can create more issues during hot weather. • Air purifiers can be costly and may not remove all pollution (such as gases).
Up to 50% (30-50%)	**Staying indoors**	• Immediate, zero-cost way to reduce exposure. • Close doors and windows. • Blocks large ash and debris.	• Homes may not be airtight and can still let in smoke. • Impractical for outdoor workers or others who need to leave their homes. • See air conditioning and heating unit notes above.
Varies	**Going outside wearing a face mask**	• Convenient if you need to leave home for work, travel, or be outdoors during smoke. • Effectiveness depends on an *airtight* face seal. • Disposable N95 or P100 respirator masks are affordable and widely available. ***Refer to handout B for proper mask options.***	Only certain masks filter smoke (N95 or P100 respirators). Such masks: • Not available for small children/babies • May not be recommended for those with lung/heart disease • Don't protect against gas pollutants • A false sense of security if not worn properly • Can be uncomfortable to work in, especially in the heat • Buying/replacing masks often is an expense. Repeated use can reduce a mask's effectiveness. • Does not work as effectively with facial hair.

Modified from: Xu R, et al. Wildfires, global climate change, and human health. New England Journal of Medicine. 2020 Nov 26;383(22):2173-81.

Staying safe during and after fires:

Be W.A.R.E.

Here's an easy way to remember what to do during and after a large fire.

W **WIDEN**	Widen your distance from the smoke.	 The safest way to reduce exposure is to leave the area.
A **ATTENTION TO AIR QUALITY**	Attention to Air quality. Assume the smoke is dangerous.	If you can't leave or are facing smoke: • Stay indoors. Close doors and windows. Stay updated on evacuation notices. • Wear masks outside (N95 or P100). Keep extras in your emergency kit. • Use air purifiers. Reduce indoor air pollution from gas stoves, candles, air fresheners, perfumes, and harsh cleaning solutions. • Check smoke levels through the EPA AirNow Smoke and Fire Map. https://fire.airnow.gov/ 
R **REDUCE DIRECT CONTACT**	Reduce direct contact with fire debris by wearing protective gear after the fire.	 Wear appropriate personal protective equipment (PPE) when handling fire debris, including soot, char, ash, or dust.
E **EMPHASIZE WELLBEING**	Emphasize physical and mental well-being. Check in on loved ones. Seek support when needed.	Talk with others and check in on loved ones and neighbors. Prioritize basic needs such as eating, sleeping, and housing. Outside of essential information, take breaks from media, which can increase stress. 

Learning Activity:

Each scenario below takes place during and after a fire in or near the fire zone.

Consider each person below: *What exposures might they have? What could help reduce their exposure?*



1. **Grace**: She is 10 years old, has asthma, lives directly across from the fire zone, but her apartment is not damaged, and she walks to school.



2. **Clara**: She is 60 years old, has high blood pressure, and works in housekeeping in the fire zones. It's hard for her to do housekeeping while wearing a mask, and she doesn't think she needs to wear one indoors. She doesn't want her clients to think she is sick because she is wearing a mask.



3. **Juan**: He is 35 years old, evacuated from his home during the worst smoke days, but strong winds and dust are frequent during the ongoing clean-up and rebuilding. He has been concerned about fire-related pollutants and has bought high-quality air purifiers to run daily.

Key point!

We want to protect ourselves and those we care about from toxic exposure, such as smoke and soot in dust after a fire, especially if we are at higher risk. Some people may face greater health risks, higher exposures, or fewer ways to protect themselves after a fire.