Air Quality and Your Health

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Americans spend about 90% of their time indoors, where air pollution can be two to five times higher than outdoor levels. Sometimes it’s more than 100 times higher.

Most people check the weather forecast daily but never think about air quality.

This oversight can be dangerous. Air pollution contributes to heart attacks, strokes, asthma attacks, and even premature death. The fine particles in polluted air can travel deep into your lungs and enter your bloodstream, affecting organs throughout your body.

The good news? You can protect yourself with the right knowledge and tools. The U.S. Environmental Protection Agency and Centers for Disease Control and Prevention have created systems to track air quality and provide clear guidance on when it’s safe to be outdoors and when you should stay inside.

Understanding the Air Quality Index

The Air Quality Index is your daily guide to breathing safely. This simple, color-coded system translates complex pollution data into information anyone can use to make smart decisions about outdoor activities.

What Is the AQI?

The AQI is a nationally uniform index developed by the EPA to report and forecast daily air quality. It takes complex air pollution data and translates it into a single number, corresponding color, and clear health advisory.

The index tracks five major air pollutants regulated under the Clean Air Act: ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide.

The AQI scale runs from 0 to 500. Higher values mean greater pollution levels and greater health concerns. A key number to remember is 100. An AQI value of 100 generally corresponds to the National Ambient Air Quality Standard for that specific pollutant—the standard set by the EPA to protect public health.

AQI values at or below 100 are generally considered satisfactory. When values rise above 100, air quality becomes unhealthy, first for sensitive groups, then for everyone as values get higher.

The Color-Coded System

The AQI is divided into six color-coded categories, each representing a different level of health concern.

Good (0-50) – Green

Air quality is satisfactory, and air pollution poses little or no risk. It’s a great day to be active outside.

Moderate (51-100) – Yellow

Air quality is acceptable. However, there may be risk for some people, particularly those unusually sensitive to air pollution. Unusually sensitive individuals should consider making outdoor activities shorter and less intense.

Unhealthy for Sensitive Groups (101-150) – Orange

Members of sensitive groups may experience health effects. The general public is not likely to be affected. People in sensitive groups should reduce prolonged or heavy exertion outdoors and take more breaks.

Unhealthy (151-200) – Red

Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. Sensitive groups should avoid long or intense outdoor activities. Everyone else should reduce prolonged or heavy exertion.

Very Unhealthy (201-300) – Purple

Health alert: The risk of health effects is increased for everyone. Sensitive groups should avoid all outdoor exertion. Everyone else should limit outdoor exertion.

Hazardous (301+) – Maroon

Health warning of emergency conditions. The entire population is more likely to be affected. Everyone should avoid all outdoor exertion.

Checking Your Local Air Quality

Accessing your local AQI is simple and available through multiple platforms. The official source is AirNow.gov, a partnership between the EPA, CDC, NASA, NOAA, National Park Service, and state, local, and tribal air agencies.

The AirNow Website: Visit AirNow.gov to see an interactive map with current and forecasted AQI values for your specific location. The website features a dedicated Fire and Smoke Map for tracking wildfire-related pollution.

The AirNow Mobile App: Download the free AirNow app for real-time data and forecasts on the go.

Email Notifications: Sign up for EnviroFlash to receive free email alerts when air quality in your area is forecast to be unhealthy.

Weather Forecasts: Many local TV news broadcasts, newspapers, and weather apps now include daily AQI forecasts alongside weather reports.

The AirNow system's reliability was tested during the 2018 California wildfires when massive traffic surges overwhelmed the original system. The EPA migrated AirNow to a scalable cloud-based platform, which remained completely stable during even larger traffic spikes caused by Canadian wildfires in 2023.

The Two Biggest Threats: Ozone and Particle Pollution

While the AQI tracks five major pollutants, the CDC and EPA consistently identify two as posing the greatest and most widespread threat to public health: ground-level ozone and particle pollution. These pollutants are responsible for the vast majority of unhealthy air quality days and are linked to serious health problems.

Ground-Level Ozone: The Invisible Irritant

It's important to distinguish between "good" and "bad" ozone. "Good" ozone exists naturally in the stratosphere, where it forms a protective layer shielding Earth from harmful ultraviolet radiation. "Bad" ozone is harmful ground-level pollution and the main ingredient in smog.

How Ozone Forms

Ground-level ozone isn’t emitted directly from any source. It’s a secondary pollutant created by chemical reactions between nitrogen oxides and volatile organic compounds in the presence of sunlight and heat.

Primary sources of these precursor pollutants are emissions from cars, trucks, power plants, industrial boilers, refineries, and chemical plants. Because sunlight and heat accelerate the reaction, ozone levels are most likely to become unhealthy on hot, sunny days, particularly in urban areas.

This direct link to temperature means climate change is projected to increase ground-level ozone pollution in some regions, further exacerbating health risks.

Health Effects of Ozone

Ozone is a powerful oxidant that can irritate and inflame the respiratory system. The CDC compares the damage ozone does to lung lining to a sunburn on skin.

Breathing ozone can cause immediate symptoms including:

- Coughing
- Sore or scratchy throat
- Pain when taking a deep breath
- Wheezing
- Shortness of breath

Beyond these acute symptoms, ozone exposure can:

- Inflame and damage airways, making lungs more susceptible to infection
- Aggravate chronic lung diseases like asthma, emphysema, and chronic bronchitis
- Increase frequency and severity of asthma attacks
- Lead to increased hospital admissions and emergency room visits for respiratory illnesses

Who’s Most at Risk from Ozone

While ozone can affect anyone, some groups are particularly vulnerable:

- People with pre-existing lung diseases like asthma or COPD
- Children and teenagers, because their lungs are still developing and they tend to be more active outdoors when ozone levels are high
- Older adults
- People of all ages who work or exercise vigorously outdoors

See also **U.S. Health Statistics: CDC WONDER and NCHS**

Particle Pollution: The Microscopic Danger

Particle pollution, also known as particulate matter (PM), is a complex mixture of extremely small solid particles and liquid droplets suspended in air. It can include dust, dirt, soot, and smoke. Health risk from these particles is directly linked to their size.

Sources of Particle Pollution

Particle pollution comes from various sources. Some particles are emitted directly into air from construction sites, unpaved roads, fields, smokestacks, and fires. However, most fine particles form in the atmosphere through complex chemical reactions involving pollutants like sulfur dioxide and nitrogen oxides emitted from power plants, industries, and vehicles.

This reveals a critical aspect of air pollution: a single precursor like nitrogen oxides from car exhaust contributes to formation of both ozone and particulate matter, creating a web of interconnected threats from a single source.

Understanding Particle Size

The EPA classifies particles based on their diameter:

PM10: Inhalable particles with diameters of 10 micrometers and smaller. This includes dust from roads, farms, and construction sites. They're large enough to irritate eyes, nose, and throat.

PM2.5: Fine inhalable particles with diameters of 2.5 micrometers and smaller. To put this in perspective, the average human hair is about 70 micrometers in diameter—making it 30 times larger than the largest PM2.5 particle.

PM2.5 particles are far more dangerous because their tiny size allows them to bypass the body's natural defenses and travel deep into lungs. From there, they can enter the bloodstream, transforming a respiratory exposure into a systemic health threat affecting multiple organs.

Health Effects of Particle Pollution

The ability of PM2.5 to enter the bloodstream explains why it's linked to such a wide and severe range of health problems. Scientific studies have linked particle pollution exposure to:

- Premature death in people with heart or lung disease
- Nonfatal heart attacks and strokes
- Irregular heartbeat
- Aggravated asthma and decreased lung function
- Increased respiratory symptoms like coughing and difficulty breathing
- Lung cancer
- Problems with babies at birth, such as low birth weight

Who's Most at Risk from Particle Pollution

Groups most likely to be harmed by particle pollution include:

- People with heart or lung diseases, such as asthma, COPD, or coronary artery disease
- People with diabetes
- Older adults
- Babies and children

According to the EPA, minority and low-socioeconomic status populations may also be more vulnerable due to higher exposure rates from proximity to industrial sources and underlying health issues.

Other Major Air Pollutants

Beyond ozone and PM, the AQI tracks three other criteria pollutants that can pose significant health risks. Understanding these pollutants is important, especially because their risks are often defined by proximity to a source—a busy roadway, malfunctioning appliance, or industrial facility.

Carbon Monoxide: The Silent Killer

Carbon monoxide is a colorless and odorless gas, which makes it particularly dangerous. It’s produced whenever fuel like gas, oil, wood, or charcoal is burned incompletely.

Sources and Risks

The greatest outdoor sources are cars, trucks, and other vehicles. However, the most acute poisoning risk comes from indoor sources. Dangerous levels of CO can build up

from malfunctioning or improperly used fuel-burning appliances—furnaces, gas water heaters, gas stoves, and unvented space heaters.

Idling a car in an attached garage, even with the door open, can cause fatal CO buildup inside the home. This makes CO a highly localized threat, determined by the state of your appliances and your actions within your home.

Health Effects

CO’s toxicity comes from its ability to bind to hemoglobin in blood over 200 times more effectively than oxygen. This process blocks oxygen from being transported to vital organs like the heart and brain.

Low-level exposure can cause fatigue and chest pain, especially in people with heart disease. As levels increase, symptoms escalate to severe headaches, dizziness, confusion, nausea, and fainting. At very high concentrations, most likely to occur indoors, CO poisoning can cause unconsciousness and death within minutes.

Lead: A Persistent Legacy Threat

Lead is a heavy metal that poses serious health risk, particularly to children. Its environmental behavior is that of a legacy pollutant: while active emissions have been drastically reduced, it persists in the environment from past contamination.

Sources and Current Risks

Thanks to the EPA's successful effort to remove lead from motor vehicle gasoline, levels of lead in air have decreased by 98% since 1980. Today, main sources of airborne lead are ore and metal processing, piston-engine aircraft that still use leaded aviation fuel, and lead-acid battery manufacturers.

A significant risk remains from lead that has settled from air into soil over decades, where it can be ingested by children playing outdoors or tracked inside as dust.

Health Effects

Once in the body, lead is distributed by blood and accumulates in bones. It's toxic to nearly every organ system but especially damaging to the nervous system.

Infants and young children are uniquely vulnerable because their growing bodies absorb more lead, and their brains and nervous systems are more sensitive to its effects. Even low levels of lead exposure in children can lead to permanent consequences including behavior and learning problems, lowered IQ, hyperactivity, slowed growth, and hearing problems.

For pregnant people, lead stored in bones can be released and pass to the developing fetus, causing serious harm.

Nitrogen Dioxide: A Roadside and Indoor Hazard

Nitrogen dioxide is a highly reactive gas and key indicator for the larger group of nitrogen oxides. Like CO, it’s a highly localized threat.

Sources and Risk Patterns

NO_2 primarily gets into air from burning fuel. Major sources include emissions from cars, trucks, buses, power plants, and off-road equipment. Because of this, NO_2 levels are often significantly higher near major roadways.

This means people who live, work, or attend school near busy roads can experience much higher exposures. Indoor sources also contribute, particularly unvented combustion appliances like gas stoves and kerosene heaters.

Health Effects

Breathing air with high concentrations of NO2 can irritate airways. Short-term exposures can aggravate respiratory diseases, particularly asthma, leading to coughing, wheezing, and difficulty breathing. Longer exposures may contribute to asthma development and increase susceptibility to respiratory infections.

Groups most at risk are people with asthma, children, and older adults.

Sulfur Dioxide: An Industrial and Volcanic Pollutant

Sulfur dioxide is a colorless, reactive gas with a strong odor, indicative of the broader group of sulfur oxides.

See also **HIV Prevention, Testing, and Treatment**

Sources and Risk Patterns

The largest source of SO2 in the atmosphere is burning fossil fuels by power plants and other industrial facilities, such as metal smelters. Therefore, exposure risk is highest for those living near these large industrial point sources.

Other sources include locomotives and ships that burn high-sulfur fuel, as well as natural sources like volcanoes. For example, Kilauea Volcano in Hawai'i Volcanoes National Park can emit extremely high levels of SO2.

Health Effects

SO2 irritates the respiratory system and can make breathing difficult. People with asthma, especially children, are particularly sensitive to these effects. SO2 can also react with other compounds in the atmosphere to form fine sulfate particles, contributing to the overall burden of dangerous PM2.5 pollution.

Protecting Your Health from Air Pollution

Knowing the risks of air pollution is only half the battle. The CDC and EPA provide clear, actionable guidance on reducing exposure and protecting health. Think about these strategies through the “Hierarchy of Controls”—a framework that prioritizes the most effective actions first.

Avoidance and Elimination: First Line of Defense

The single most effective way to protect yourself is avoiding breathing polluted air in the first place.

Check the AQI Daily

Make it a habit to check the forecast at AirNow.gov or your local weather source. This transforms air quality from something that happens to you into something you can plan around.

Stay Indoors on High-Pollution Days

When the AQI is in “Unhealthy” ranges (Orange, Red, Purple, or Maroon), the best way to reduce exposure is staying indoors as much as possible, with windows and doors closed. This is especially important during wildfire smoke events.

If you can’t stay cool at home without opening windows, seek shelter in a public building with air conditioning, like a library or community center.

Eliminate Indoor Sources

The most effective strategy for improving indoor air is controlling pollutants at their source:

- Forbid smoking inside the home
- Never idle cars or use gasoline-powered engines in an attached garage
- Ensure all fuel-burning appliances are properly maintained and vented to the outside

Engineering Controls: Modifying Your Environment

If you can’t completely avoid exposure, you can modify your environment to make the air cleaner.

Create a “Clean Room”

During heavy smoke or pollution events, designate one room in your home (ideally one without many windows or doors) as a clean air space. Close it off from outside air and use a portable air cleaner to keep the air in that room as clean as possible.

Filtration Is Key

HVAC Systems: If your home has central heating, ventilation, and air conditioning, upgrade to a high-efficiency filter. Look for a filter with a Minimum Efficiency Reporting Value (MERV) of 13 or higher, or the highest rating your system can accommodate.

During a pollution event, set the system fan to “on” instead of “auto” to continuously filter air, and close the fresh air intake or set it to “recirculate” to prevent bringing more polluted air inside.

Portable Air Cleaners: Use a portable air cleaner with a high-efficiency particulate air (HEPA) filter in rooms where you spend the most time, such as the bedroom. These devices are highly effective at removing fine particles from indoor air.

Install Carbon Monoxide Detectors

Because CO is colorless and odorless, a detector is the only way to know if dangerous levels are present. Install battery-operated or battery-backup CO detectors near every sleeping area in your home and check batteries regularly.

Administrative Controls: Changing Your Behavior

Adjusting daily routines and activities can significantly reduce exposure.

Modify Outdoor Activities

When the AQI is elevated, don’t necessarily cancel all plans. Instead, adapt them:

Reduce Intensity: Choose less strenuous activities, like walking instead of running, so you breathe less heavily.

Reduce Time: Shorten the duration of outdoor activities.

Change Timing: For ozone pollution, which peaks in the afternoon, schedule outdoor activities for morning or evening.

Avoid “Hot Spots”: Stay away from high-pollution zones like busy roads and highways, especially during rush hour, where levels of PM and NO_2 are highest.

Personal Protective Equipment: Your Last Line of Defense

When you must be outdoors during high-pollution events, particularly during wildfires, wearing the right kind of mask can provide critical protection.

Choose the Right Respirator

Standard cloth masks, surgical masks, or bandanas are not effective at filtering fine particles found in wildfire smoke. You must use a NIOSH-approved particulate respirator. Look for “NIOSH” and the rating “N95” or “P100” printed on the respirator itself. These are designed to filter out at least 95% of airborne particles.

A Good Fit Is Crucial

A respirator is only effective if it forms a tight seal around your face. Choose a model and size that fits snugly over your nose and under your chin. Facial hair can prevent a good seal.

Every time you put on the respirator, perform a “user seal check” by following manufacturer’s instructions to ensure air isn’t leaking around the edges.

Guidance for Children

Finding a proper respirator for a young child is challenging, as NIOSH-approved respirators are typically designed for adults in workplace settings. If you must take a child outside in smoky conditions, choose the best-fitting, multi-layered mask or respirator you can find.

Ensure it fits snugly over their nose and under their chin without impairing vision. If a child is uncomfortable, they’re more likely to wear it incorrectly, reducing effectiveness.

High-Risk Groups Need Extra Protection

While air pollution can harm anyone, the CDC and EPA consistently identify specific groups more susceptible to its effects. A person's vulnerability isn't determined by a single medical condition—it can be a combination of biological sensitivity, higher environmental exposure, and socioeconomic factors.

This intersection means some communities bear a disproportionate burden of air pollution's health impacts. For these at-risk individuals, paying attention to the AQI and taking protective measures is especially critical.

Children and Teenagers

Children are at greater risk from air pollution for several reasons: their lungs are still developing, they breathe more air per pound of body weight than adults, and they're more likely to be active outdoors when pollution levels are high.

Nearly 1 in 13 school-aged children has asthma, the leading cause of school absenteeism due to chronic illness. Exposure to pollutants and allergens common in schools can trigger asthma symptoms.

The CDC and EPA provide specific "Air Quality and Outdoor Activity Guidance for Schools". This guidance recommends that on "Unhealthy for Sensitive Groups" (Orange)

days, schools should provide more breaks and less intense activities during recess and PE. On “Unhealthy” (Red) days, longer or more intense activities should be moved indoors or rescheduled.

See also **How to Contact the CDC [2025]**

Older Adults

Older adults are more susceptible to severe effects of air pollution, particularly from ozone and particulate matter. Studies show the absolute effect of ozone on mortality is considerably higher in older adults. They’re also at higher risk for cardiovascular impacts of PM, including heart attacks and strokes.

Pregnant People

Exposure to air pollution during pregnancy can affect the developing fetus.

Lead: Lead accumulated in a pregnant person’s bones can be released along with calcium and pass to the fetus, potentially harming the baby’s brain, kidneys, and nervous system.

Wildfire Smoke: The CDC identifies pregnant people as a high-risk group for wildfire smoke health effects.

Particulate Matter: Exposure to PM2.5 has been linked to problems at birth, such as low birth weight.

Individuals with Asthma or COPD

People with chronic respiratory diseases like asthma or Chronic Obstructive Pulmonary Disease are among the most sensitive to air pollution.

Nearly all major pollutants—ozone, PM, NO2, and SO2—can irritate airways and trigger symptoms or attacks. It’s critically important for individuals with asthma to carefully follow their prescribed asthma action plan on days when air pollution is high, including having quick-relief medication readily available.

Individuals with Heart Disease or Diabetes

These individuals face severe and acute risk, primarily from particulate matter. The fine particles in PM2.5 can enter the bloodstream and contribute to inflammation and other systemic effects that can trigger heart attacks, strokes, and irregular heartbeats.

The EPA provides a “Healthy Heart Toolkit” with detailed recommendations. On high-pollution days, individuals with heart disease should avoid strenuous activity, especially near busy roads, and know the warning signs of heart attack or stroke.

Indoor Air Quality: Where We Spend 90% of Our Time

Public health concerns about air quality aren’t limited to outdoors. The EPA estimates Americans spend approximately 90% of their time indoors, where concentrations of some pollutants can be two to five times—and sometimes more than 100 times—higher than typical outdoor levels.

Poor indoor air quality can cause immediate symptoms like headaches, fatigue, dizziness, and irritation of eyes, nose, and throat, and can contribute to long-term health effects like respiratory diseases and cancer.

Dynamic Indoor Air Strategy

The optimal strategy for managing indoor air quality is dynamic and depends entirely on outside air quality. This creates a crucial decision point for every household:

When outdoor air is CLEAN (low AQI): The primary goal is diluting pollutants generated inside the home. The best strategy is ventilation—bringing fresh outdoor air in.

When outdoor air is POLLUTED (high AQI): The primary goal is keeping outdoor pollutants from getting in. The best strategy is sealing the home and using filtration.

Common Indoor Pollutants

Most indoor air quality problems are caused by sources inside the building itself.

Combustion Pollutants

Carbon monoxide and particulate matter from fuel-burning appliances like furnaces, stoves, and fireplaces, as well as tobacco smoke.

Volatile Organic Compounds (VOCs)

A wide range of chemicals emitted as gases from products like paints, cleaning supplies, pesticides, building materials, and furnishings.

Radon

A naturally occurring, radioactive gas that is invisible and odorless. It can seep into homes from the ground through foundation cracks and is the second leading cause of lung cancer in the U.S. All homes should be tested for radon.

Biological Agents

Mold, which grows in areas with excess moisture, pet dander, and pollen are common biological pollutants that can trigger allergies and asthma.

Secondhand Smoke

A major source of indoor air pollution containing a complex mix of harmful gases and fine particles.

Three Core Strategies for Cleaner Indoor Air

The EPA outlines three basic strategies for improving indoor air quality.

Source Control: Eliminating Pollutants at the Source

This is the most effective way to manage indoor air quality. If you can eliminate or reduce the pollution source, you won't have to worry about cleaning it out of the air.

Examples: Ensure all combustion appliances are properly installed, maintained, and vented outdoors. Never allow smoking indoors. Choose building materials and furniture made with solid wood instead of pressed wood products that can off-gas formaldehyde. Select low- or no-VOC paints and cleaning products. Fix all water leaks promptly to prevent mold growth.

Ventilation: Bringing in Fresh Air

When outdoor air is clean, increasing the amount of fresh air coming indoors can lower the concentration of pollutants generated inside.

Methods: Open windows and doors to bring in fresh air. Use exhaust fans in kitchens and bathrooms to remove pollutants and moisture at the source and vent them outside. If you have an HVAC system, ensure it’s operating correctly and meeting ventilation design codes for your home.

Air Cleaning and Filtration: Removing Pollutants from Air

This strategy supplements source control and ventilation and becomes the primary indoor strategy when outdoor air is polluted.

Methods: Use portable air cleaners with HEPA filters, which are effective at capturing airborne particles. Upgrade the filter in your central HVAC system to a MERV 13 or higher-rated filter to capture more pollutants as air circulates through your home.

For more information on choosing the right device, consult the EPA’s “Guide to Air Cleaners in the Home”.

Taking Control of Your Air Quality

Understanding air quality and its health impacts puts you in control of your daily exposure to pollution. Whether it's checking the AQI before your morning run, installing a carbon monoxide detector in your home, or upgrading your HVAC filter, small actions can make a big difference in protecting your health.

The tools and information are available—from the real-time data at AirNow.gov to the specific guidance for sensitive groups. The key is making air quality awareness part of your daily routine, just like checking the weather.

Air pollution affects everyone, but it doesn't have to control your life. With the right knowledge and preparation, you can breathe easier knowing you're taking steps to protect yourself and your family from the invisible threats in the air around us.

Our articles make government information more accessible. Please consult a qualified professional for financial, legal, or health advice specific to your circumstances.