



Using Air Quality Sensors for Smoke: What to Consider

Air sensors—also called portable, low- or lower-cost air quality sensors or sometimes “monitors”—have made it easier for people to monitor the air quality where they spend time. Because they provide localized readings, air sensors can help you make decisions about personal activities, but they are not intended to replace the highly accurate readings taken by regulatory monitors typically used by state, local, and Tribal air agencies.

Learning how to use an air sensor can help you get the most useful information from your device during a wildfire smoke event. This fact sheet focuses on using sensors to measure fine particulate matter (PM_{2.5}), one of the main pollutants in wildfire smoke. Some air sensors measure other pollutants like PM₁₀ or PM₁, nitrogen oxides, carbon dioxide, and ozone. The recommendations in this fact sheet may not apply to these sensors because they may perform differently than PM_{2.5} sensors.

How Air Sensors Can Help You

During wildfire smoke events, air sensors can provide useful, real-time information about PM_{2.5} levels outdoors and indoors. Data from sensors can help you:

- Make decisions about where to go to avoid smoke exposure.
- Identify better times to go outside (ideally when smoke levels are relatively low).
- Understand what actions, like air filtration, most effectively reduce your smoke exposure indoors.

How to Choose an Air Sensor

Look for a sensor that measures PM_{2.5}. Here are some things to consider before purchasing a sensor to measure smoke:

How will you access the data from your sensor?

Some sensors:

- Connect to the internet via Wi-Fi or cellular networks and allow you to view or download data from a website or app.
- Store data on a removable memory card that you can analyze on a computer.
- Display graphics, colors, or numbers directly on the device.

What type of sensor best fits your needs?

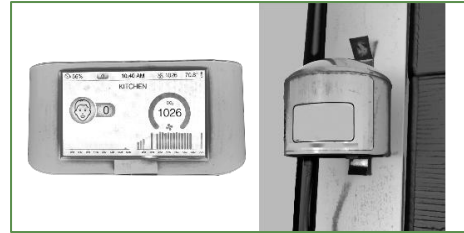
For example:

- A sensor with a display provides information about current PM_{2.5} levels quickly.
- One that connects to a website or app will allow you to view your PM_{2.5} levels remotely or compare it to other areas.

How will you power the sensor?

Some sensors:

- Plug into a wall outlet.
- Use small solar panel/battery systems.
- Run off a battery.



Indoor and outdoor sensors provide localized readings.

Where to Place an Air Sensor

Before you place an air sensor, consider your objectives: *What do I want to learn about PM_{2.5} from this sensor?*

For example:

- Using sensors outdoors can help you decide whether to hold outdoor sports practice or engage in other outdoor activities.
- Using a sensor in the room where you will use an air cleaner can help you decide when to turn on your air cleaner.

These objectives will help you understand where to place the sensor and which areas to avoid.

- Try to place the sensor 3–6 feet off the ground (at breathing height) and in a location that does not restrict airflow to the sensor.
- Avoid placing indoor sensors near exterior doors, windows, stoves, heating and cooling vents, humidifiers, or showers where changes in temperature and humidity can negatively impact sensor readings.

In addition, consider logistics as you select your location, including:

- Providing power for the sensor.
- Accessing the sensor data.
- Connecting the sensor to an existing communications network.
- Placing the sensor where it will not be unplugged or damaged.
- Getting permission to monitor at the site, if not on your property.

See the Resources section for links to more detailed information about siting sensors.

Consider Air Sensor Performance

Some monitoring applications may require higher quality data and more accurate sensors. For information on sensor accuracy and related topics, see:

- EPA: [*The Enhanced Air Sensor Guidebook*](#)

- EPA: [Performance of low-cost indoor air pollution monitors](#)
- South Coast Air Quality Management District: [Air Quality Sensor Performance Evaluation Center \(AQ-SPEC\)](#)

See the [Understanding Sensor Data](#) Wildfire Guide fact sheet to learn more.

EPA developed and tested [air sensor performance standards](#), though none explicitly account for performance in smoke. EPA researchers [made several recommendations](#) for how the protocols could be adapted to better understand performance in smoke.

Resources

Scan the QR code to the right to access an online version of this fact sheet and the additional resources below.



Information on Air Quality

Check out the AirNow Fire and Smoke Map, your state air quality website, or your local news for air quality information. Access these resources using the links below!

- [AirNow Fire and Smoke Map](#)
 - [IOS App](#)
 - [Android App](#)
- [Wildfire Guide Fact Sheets](#)
- [Resources and Information on Wildland Fires and Smoke](#)
- [Infographics on Staying Safe Before, During and After Fires](#)

Additional Resources

- [EPA's Air Sensor Toolbox](#)
- [EPA's Guide to Siting and Installing Air Sensors](#)
- [EPA's Evaluation of Air Sensors](#)
- [EPA's Air Quality Sensors Testing and Targets](#)
- [EPA's How to Evaluate Air Sensors for Smoke Monitoring Webinar Archive](#)



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Using Air Quality Sensors for Smoke: Understanding Sensor Data

During smoke events, air quality sensors can provide localized information about outdoor and indoor air quality. Air sensors may help you make decisions about where to spend time or when to go outside when wildfire smoke is affecting your area. They may also help you understand how to reduce your smoke exposure indoors. This fact sheet focuses on the use of sensors to measure fine particulate matter (PM_{2.5}), because it is one of the main pollutants in wildfire smoke. See the [What to Consider](#) Wildfire Guide fact sheet for information about choosing and placing air sensors.

How You Can Use PM_{2.5} Sensor Data

These simple approaches can help you understand your PM_{2.5} sensor data:

- **Examine trends over time in one location**—Sensor data can help you see when PM_{2.5} levels are starting to get better or worse in real time. For example, you can see:
 - How much PM_{2.5} levels drop when you use a portable air cleaner or run your central air system with a higher-efficiency filter.
 - How activities in your home can contribute to increased PM_{2.5} levels (e.g., burning candles, cooking).
- **Compare PM_{2.5} levels in different locations**—Sensor data can help you compare PM_{2.5} levels in different locations. For example, you can:
 - See whether PM_{2.5} levels are lower indoors or outdoors.
 - Compare PM_{2.5} levels in different outdoor locations.
 - Identify which room in your house has the lowest PM_{2.5} levels.

Try to compare data from sensors of the same type using the same units (for example, particle mass, number, or air quality index). If PM_{2.5} levels are trending higher at your location, take steps to reduce your exposure. Learn more in our other [Wildfire Guide Fact Sheets](#).

Understanding Sensor Data Quality

PM_{2.5} sensors have a higher level of uncertainty and may not give the same readings as the highly accurate PM_{2.5} regulatory monitors typically used by state, local and Tribal air agencies. They can also be affected by unrelated interferences, such as fog, relative humidity, and temperature.

PM_{2.5} sensors are good for measuring smoke particles nearby, but they do not measure visible smoke high in the sky, visible large ash on surfaces, or gases.

Trust your senses. If you are experiencing health effects from smoke, take action to reduce your exposure, regardless of what a sensor is reading.

Checking the Quality of Your Sensor Data

For outdoor sensors, comparing your sensor's data to data from other sensors or reference monitors nearby can indicate how well your sensor is working. While they may not report the same values due to highly localized sources, different data corrections, or error, they should show similar trends over time.

Recognizing Problems With Sensor Data

Air sensors sometimes fail, and you may not notice the failure right away. Routinely review your data to help identify these common problems with PM_{2.5} sensors:

- **Suspicious data.** Values that do not change (stuck data), sudden frequent jumps in the data, or suddenly very erratic data may indicate a problem.
- **Consistently very low values.** If the sensor reports very low values, you may not be able to tell whether this is accurate or a sensor malfunction. You can do a simple test to see if the sensor is responding, such as safely lighting a match nearby.
- **Large differences in duplicate measurements.** Some sensor products report data from two sensors in the same unit. You can compare the data to make sure they both respond similarly.
- **Declining performance over time.** Sensor readings may become less accurate when sensors have been in operation for a long time or during high PM_{2.5} levels.

If you notice a problem with the data from your air sensor, consult the manufacturer's recommendations for troubleshooting or replacing the device.

Correcting PM_{2.5} Sensor Data

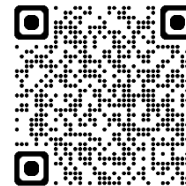
Uncorrected sensor data can be useful for detecting trends or comparing PM_{2.5} levels in different locations.

Correction equations, including equations specifically for smoke, may be available for some sensors. Applying these equations can improve the accuracy of the sensor data. For example, AirNow applies an EPA correction equation before showing sensor data on the [Fire and Smoke Map](#).

Note: Air sensors typically report pollutant levels every few seconds or minutes. Use caution if comparing these very short-term sensor readings directly to the [National Ambient Air Quality Standards \(NAAQS\)](#) or the U.S. Air Quality Index for PM_{2.5}, which are based on 24-hour averages. For the official data used to determine compliance with the PM_{2.5} NAAQS, visit EPA [Air Quality Design Values](#).

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- [**EPA's Guide to Siting and Installing Air Sensors**](#)
- [**EPA's Best Practices Guide for Improving Indoor Air Quality in Commercial/Public Buildings During Wildland Fire Smoke Events**](#)



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