

Air Quality Sensors

The last several years have seen a rise in the number of low-cost air quality sensor devices that measure a variety of air pollutants. These sensors offer an opportunity for members of the community to explore interests in local air quality. Sensors can aid in determining local air quality trends for educational and research purposes. The Environmental Protection Agency (EPA) has published the [Air Sensor Toolbox](#) which provides valuable information regarding air sensors.

While sensors can be useful for understanding air pollution and for knowing when pollution concentrations may be high in a specific location, these sensors do not undergo the rigorous quality control and calibration procedures that are used in regulatory air monitoring. Some types of sensors perform somewhat well when compared to a regulatory-quality monitor, while other types of sensors do not. Performance varies from sensor to sensor and from pollutant to pollutant. Data collected and supported by well-placed sensors that are properly maintained can yield results that are representative of local air quality trends. This document provides guidance for the use of stationary outdoor air quality sensors, as well as maximizing data quality and interpretation.

When to Use an Air Quality Sensor

Because air sensors do not undergo the same quality control requirements that regulated air monitors do, caution should be used in selecting, purchasing, and analyzing the data that are collected. Recommended uses for air sensors include research, education, and awareness. Because of issues with accuracy and quality control, data may not be accurate enough to consistently provide exposure values but can be helpful to determine if short-term air pollution levels are increasing or decreasing. Data collected when using air sensors cannot be used to determine if an area is meeting the National Ambient Air Quality Standards established by the EPA.

Choosing an Air Quality Sensor

While there are several air sensors available for purchase, not all sensors are the same. Different sensors offer various options and features, and research should be done before choosing a sensor. Consider the following information before purchasing a sensor:

Cost. Air sensors can cost anywhere from less than a hundred dollars, all the way up to \$2,500 or more. You should factor in maintenance, lifespan, and replacement in determining your cost.

Pollutants. Air sensors can measure one or multiple air pollutants, so choose a sensor that measures the pollutant you are interested in. If you are looking to measure dust or smoke, consider choosing a sensor that measures particulate matter.

Accuracy. The accuracy of air sensors can vary between models, so it is important to do some research before purchasing an air sensor. The South Coast Air Quality Management District has established the [Air Quality Sensor Performance Evaluation Center](#) to evaluate the performance of air quality sensors and is a good tool to consult before purchasing an air sensor. The [Air Sensor Toolbox](#) also has published evaluations of air sensors.

Maintenance and Operation. Sensors may require regular cleaning and other maintenance to ensure better air quality data. It is important that a sensor have a complete and informative user manual, and to follow any recommendations that are provided. It is also important to know how the sensor collects data and how to access it. Some air sensors use memory cards while others use wireless internet connections.

Choosing a Location for the Air Sensor

It is important to consider several things when choosing a location for an air sensor. It must have access to power and possibly a wireless internet connection to operate and collect data. For more accurate data, sensors should not be placed near grills, idling vehicles, campfires, or roadways. Sensors should be placed 2-15 meters above ground level to represent human breathing height more accurately. Ideally, the air sensor should have unrestricted airflow for 270° and be placed at least 2 meters from walls and 10 meters away from any trees that are taller than the inlet of the sensor. These considerations can help improve the accuracy of your air sensor.

Collecting Quality Data

If you are using your air sensor for research purposes and to determine the accuracy of your data, collocation is recommended. Collocation is a quality control technique by which multiple air sensors, regulatory instruments, or both operate during the same time and at the same location to compare device measurements. A comparison of multiple air sensors of the same type can provide insight into the reliability of the sensors. A comparison between air sensors and regulatory instruments provides information on the accuracy of the sensor with federal quality assured methods. In Buncombe County, these comparisons can be made using the Community Air Sensor Shelter located at the Buncombe County Board of Education Air Quality Monitoring Site.¹ If it is possible, collocation should be used throughout the duration of your study. If this is not possible, collocation should be completed before and after the study occurs and across representative weather conditions.

Understanding the Data

Data collected from air sensors should be reviewed for accuracy and completeness. Any outliers or extreme values that are much smaller or larger than most of the data should be removed. To assist in inputting and analyzing data, the EPA has created the [Macro Analysis Tool](#) that provides a template for comparing sensor data over time. If you want to see how the data compares to the [Air Quality Index \(AQI\)](#), you may need to use the [AQI Calculator](#) to convert raw concentrations since many sensors do not produce an AQI value. The AQI is a color-coded index for reporting daily air quality that relate to health-based standards for EPA criteria pollutants. When making these comparisons, it is important to use the [same averaging time](#) that the EPA uses for whichever pollutant is being monitored. Air sensors often report data averaged over a 1- to 5-minute duration, which can show a great deal of variability compared to a 1-hour or 24-hour average.

Useful Links:

[Air Sensor Toolbox](#)

[EPA Air Sensor Guidebook](#)

[North Carolina Division of Air Quality Air Sensors FAQ](#)

[Air Quality Sensor Performance Evaluation Center](#)

¹The Community Air Sensor Shelter located at the Buncombe County Board of Education Air Quality Monitoring Site is currently under construction and not yet available for use. Please contact the Agency for more information.