

The Air Sensor Toolbox: Citizen Scientists Measure Air Quality

Case Study Overview

The town of Tonawanda, New York, has some of the state's largest industrial facilities, and in 2004 local citizens noticed something wrong with the air. Concerned about smells and smoke, they suspected a connection between air quality and chronic health problems in their community.

Organized as the Clean Air Coalition of Western New York, volunteers used simple devices to collect air samples and find out what was in the air. Sure enough, they found high levels of benzene, a known carcinogen.



Based on the results, the New York Department of Environmental Conservation worked with the Environmental Protection Agency to do further air quality testing. Ultimately, the Tonawanda Coke Corporation agreed to improve operations, monitor for leaks and upgrade pollution controls, decreasing benzene levels in the air by 86 percent.

Recognizing that citizens want to learn more about local air quality, EPA scientists are collaborating with technology developers and with federal, state, international and nongovernmental organizations on the potential use of emerging technologies to meet a wide range of air quality monitoring needs. The agency now has a website, the [Air Sensor Toolbox for Citizen Science](#), with information and guidance on new low-cost portable technologies for measuring air quality.

Project Description



Developed in 2014, the *Air Sensor Toolbox* gives information about emerging technologies, in particular those associated with low-cost sensors. It also outlines sampling methodologies, gives a set of data interpretation guidelines and offers education and outreach materials.

The toolbox begins with an Air Sensor Guidebook. Air quality sensors costing as little as \$100 are now commercially available in a wide variety of designs and with various capabilities. Using the guidebook, citizens can learn how to select and use sensors to investigate common air pollutants.

The toolbox also contains a description of a prototype monitoring system for measuring nitrogen dioxide and particulate matter in the air. The Citizen Science Air Monitor was recently developed for a citizen science pilot project. The system's operating procedures explain how to use the device to collect meaningful air quality information.

In addition, the toolbox describes research that EPA is leading on the development of mobile sensors and applications for detecting air pollutants. The goal is to help strengthen local community-based air monitoring projects. The toolbox also contains a systematic evaluation of low-cost sensors for ozone, nitrogen dioxide, particulate matter and volatile organic compounds, along with a comprehensive set of guidelines that citizen scientists can use to ensure that their data are sound.

Challenges

Data used for regulatory purposes must meet tough standards, and some have raised concerns about the quality of the data generated by citizen science projects. The toolbox has information on data quality issues that citizens need to be familiar with as they plan their projects. Although EPA does not use volunteer data directly, many states use data collected by volunteers in their own assessments.

Benefits and Outcomes

The quality of the air is fundamental to health and well-being. The nation's conventional air quality monitoring network has a limited number of stations that use expensive equipment to measure the air for a limited number of pollutants. Because location-specific data are relatively sparse, people often don't know what is in the air they breathe.

Communities are understandably concerned. As results in western New York and elsewhere show, citizen science can be part of the solution. Advances in mobile sensors and software applications offer new opportunities for community-based sensing projects.

The *Air Sensor Toolbox* gives concerned citizens technical information on next-generation air monitoring devices, including a description of new technologies and how to use them to meet a wide range of needs. The toolbox contains training materials, such as video and slide presentations, specifically designed for users of the new technologies. In the coming years, the EPA will continue to update the toolbox based on its research on emerging technologies for air quality monitoring. By using the *Air Quality Toolbox*, citizen scientists can help fill knowledge gaps about the quality of their local air, leading to regulatory action, technology improvements and less air pollution.



Tips

The *Air Sensor Toolbox* case study illustrates the following steps in the Federal Citizen Science and Crowdsourcing Toolkit:

- **Scope Out Your Problem — Know Your Tools**
The toolbox identifies key tools that project developers should consider using to ensure successful citizen science outcomes. It provides information on some of the many assistance programs that support citizen science, along with information about using low-cost sensor technologies for a wide range of applications.
- **Design a Project — List Your Resources**
The toolbox provides a guide for funding citizen science projects, listing the necessary people and other resources.
- **Manage Your Data — Acquire Your Data**
The toolbox provides guidelines that citizen science projects can use to acquire and process the information it contains.

Learn More

- Website: [Air Sensor Toolbox for Citizen Science](#)
- [The Air Sensors Guidebook](#)
- [Citizen Science Funding Guide](#)
- [Podcast for Air Quality Monitoring for Citizen Science](#)

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