EPA scientists have been conducting performance evaluations of low-cost sensor technologies for air quality measurement by comparing the data they produce with data from collocated reference monitors. With the increasing accessibility and ease-of-use of these devices, EPA recognized the need to help non-experts, such as community groups, conduct their own sensor evaluations. To meet this need, the EPA’s National Exposure Research Laboratory was awarded an internal grant through a citizen science initiative competition to conduct a community-led air sensor evaluation project. In the fall of 2016, EPA partnered with one community group and one tribal nation to conduct a sensor performance evaluation using their choice of sensor devices.

### Project Goals

Help citizen scientists and community groups learn how to use low-cost, portable air sensors, and effectively evaluate their reliability and performance via collocation with reference instruments.

### Project Partners

**Clean Air Carolina** (CAC • [www.cleanaircarolina.org](http://www.cleanaircarolina.org)) is a community action group comprised of a mix of paid staff and volunteers. Their mission is to ensure cleaner air quality for all North Carolinians through education and advocacy and by working with partners to reduce sources of pollution. Their activities include working with citizens to conduct air quality monitoring with low-cost sensors and conducting environmental educational programs for local school-based children.

**Eastern Band of Cherokee Indians** ([EBCI](https://www.ebcienvironmental.com)) is a federally recognized Native American tribe living in and around Cherokee in western NC. Their citizens conduct the EBCI Air Quality Control Program which is responsible for operating three air quality monitoring stations supporting the State of North Carolina’s and the EPA’s regulatory requirements ([www.ebcienvironmental.com](http://www.ebcienvironmental.com)).

### Approach

EPA provided each project partner
- Three copies of their selected low-cost (<$2500) air quality sensor
- A custom weather shelter
- Quality assurance and operating procedures for non-experts
- In-person training
- Bi-weekly conference calls to provide updates and address issues
- Tools and guidance to analyze data and understand results
- Template for non-experts to summarize findings

Project partners
- Conducted pre-deployment evaluations of sensors
- Conducted data collections with sensors (May-June 2017) with frequent visits to monitoring site
- Used the Macro Analysis Tool developed by the EPA (see "Tools Developed") to statistically compare the low cost sensor data with the reference monitor data
- Reported to the EPA on their experience as non-experts in deploying the sensors and data recovery and analysis

### Tools Developed by EPA

**Instruction guide for conducting a successful collocation evaluation of air sensors with regulatory grade instruments, provided as a PowerPoint presentation for easy reading and ample visual tools.**

**Example Outputs:**

- **EPA** How to Evaluate Low-Cost Sensors by Collocation with Federal Reference Method Monitors

**Topics covered:**
- Background – Low-cost sensors vs reference instruments
- Introduction to collocation
- Planning collocation
- Making measurements
- Data recovery and review
- Data comparison
- Using sensors

### Keys to Success

**Recommendations for a successful community-government partnership:**
- Agree upon goals
- Plan an approach
- Collaborate with stakeholders
- Assign responsibilities
- Communicate regularly
- Work and educate through community connections

**Partner Feedback**

“Creating a bridge between local NGO’s, regional air monitoring and the EPA is an asset that will continue to pay dividends in air monitoring, health and environmental protection.”

Terry Lansdell, Clean Air Carolina

“Now that community based science, “citizen scientist”, has become more popular, it is nice to have something explain how to collect more viable data using the low-cost sensors because most community members don’t consider the accuracy of a sensor compared to a FEM/FEM.”

Katie Tiger, Eastern Band of Cherokee Indians

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