EPA’s Air Sensor Toolbox for Citizen Scientists
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Abstract
The general public is increasingly interested in environmental data specific to their family or community. This is driven by many factors including concerns citizens have about known or perceived local pollution sources. Low-cost air pollution sensors and monitors have recently been introduced into the public domain, giving residents the opportunity to collect environmental data for their own use. This poster discusses challenges and opportunities associated with these new citizen science activities and describes emerging technologies available to support it. In addition, the poster introduces the Air Sensor Citizen Science Toolbox, including Community Air Monitoring Training, sensor evaluation reports, and the RETIGO tool.

Citizen Science: Challenges and Opportunities
Citizen Scientists are using increasingly more reliable lower cost air pollution monitors to collect environmental measurements data to better understand individual health, community exposures, conduct research, and for other purposes. However, most citizens do not have the technical training to operate environmental monitors or interpret the results and most of the lower cost environmental monitors have not been evaluated for their performance characteristics.

A Typical Low Cost Monitor:
- Inexpensive ($100 to $2000) to purchase
- Highly portable and easy to operate (often mobile)
- Requires little or no training to start collecting data
- Inexpensive to operate (replace or recharge batteries)
- Lifetime of service not expected to exceed 1-2 years

Common parameters measured by sensors:
- Particles: optical measurement (not mass measurement)
- Ozone: metal oxide and electrochemical sensors
- Oxides of nitrogen (NO, NO2): metal oxide and electrochemical sensors
- Carbon monoxide: metal oxide and electrochemical sensors
- Total volatile organic compounds (VOCs): photoionization detector (PID)
- Carbon dioxide: non-dispersive infrared sensors (NDIR)
- Computed gas data (e.g., black carbon, organic carbon, nitrate)
- Sulfur dioxide
- Speciated organics

Example devices on the market include turnkey sensors as well as original equipment manufacturer (OEM) components used in maker projects:


Notes:
- Carbon monoxide: metal oxide and electrochemical sensors
- Lifetime of service not expected to exceed 1-2 years
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Common parameters measured by sensors:

Data visualization tool: Real-Time Geospatial Data Viewer (RETIGO)
Website: www.epa.gov/retigo

RETIGO Target attributes
- Non-hardware specific – generic and flexible data input format.
- Comfortable to use for an individual with only intermediate-level experience in Excel.
- Provides interactive data visualization for geospatial air monitoring time series.
- Supports inclusion of complementary web-available data.

Next-Generation Air Measurement Research
Ongoing and new research projects evaluating/applying emerging air monitoring technologies
Region 1: CAIRSENSE, Village Green Project
Region 2: Citizen Science Air Monitor (CSAM), RETIGO
Region 3: VOC sensors (SPOD), Village Green Project
Region 4: Lead on RM (CAIRSENSE) and RESES (CitySpace) projects
Region 5: RARE (Village Green Project, AirMapper)
Region 6: RARE (Village Green Project), CitySpace
Region 7: CAIRSENSE, CitySpace, Village Green Project
Region 8: CAIRSENSE
Region 9: RARE (ozone sensors)
Region 10: RESES (PM sensors at bus stops)