4 Types of Low-Cost Air Sensor Community Science Projects

Below are descriptions of 4 different types of community projects that can be carried out using low-cost air sensors, as well as guidance you should follow to complete each type of project. Note that each project type may have different steps depending on the overall goal of the project and the level of effort it requires. Within each of the project descriptions there is a link to the Project Plan Templates. These templates are also found in the table [“What Type of Low-Cost Sensor Project Works for You?”](). It is important that you use these templates, as they will guide you in planning your project, selecting appropriate sensors, carrying out data quality checks that may be required, and deciding how your data will be handled. Not following the guidance may impact the quality and validity of the data you collect.

Please read through all 4 of the project descriptions below

before deciding which type of project you would like to do.

Type 1: General Information & Education

Level of Effort: Low

Low-cost air sensors can be used to educate students and the general public. The measurements from these monitors can show whether a pollutant is present in different environments and at different times. They can be used to learn about air pollution, the scientific method, and how to operate and use air monitoring equipment.

As a teacher or group leader, if you are interested in carrying out this type of project, download a Project Plan template from the ["4 Types of Low-cost Air Sensor Projects" table](#) on our Community Science website, and follow the recommended steps below:

1. Come up with testable questions you would like the study to answer, such as, "Is air pollution higher today compared to yesterday?" Select which one(s) you would like to test.
2. Conduct some background research on your topic of interest to help in the design of the project.
3. Develop objectives and tasks for the project to attempt to answer your questions, based on your background research.
4. Outline your experiment and develop a Project Plan. Having a plan will help you to get consistent results. Be sure to include objectives, background, sampling locations, sampling schedules and methods.
5. Once your Project Plan is completed, have it reviewed by the Project Leader or Technical Support before the start of the project.
6. Do some research on different low-cost sensors to decide which would be best for your project and budget. Sensors are available for purchase through different websites. For guidance on selecting an air sensor that is appropriate for your specific project goals, refer to the "Resources to Help You Select the Appropriate Low-Cost Sensors" section in the [Helpful Links](#). NJDEP and USEPA plan to establish a sensor loan program in the future. Check for updates on our homepage.
7. Conduct the experiment. Be sure to follow your Project Plan and make note of any changes that you make to the plan and procedures.
8. Review the results from the experiment. If the data is qualitative (for example, the low-cost sensor uses color-coded indicators for air quality levels instead of numerical readings), the uncertainty of measurements is quite high. However, the purpose of qualitative studies is primarily to demonstrate the presence of a pollutant, and to increase awareness of potential problems.

For an editable and sharable version of a Project Plan template, contact [bamweb@dep.nj.gov.](mailto:bamweb@dep.nj.gov)

For an example of a General Information & Education project, see the "Project Examples" section of the [Helpful Links](#) page.

Type 2: Personal Exposure Monitoring (Group or Individual Project)

Level of Effort: Medium-High

Low-cost air sensors can be used to measure the air pollution that a person or a group is exposed to during their daily routine. For this type of project, people wear or carry devices as they go about their day. The measurements from these sensors can be used to compare exposures indoors, during a commute to work, walking to classes, exercising, etc. Individuals can use these sensors to assist in making personal health decisions. Community groups can use these sensors to estimate exposures for individuals in environmental justice areas.

If you're interested in carrying out this type of project, download a Project Plan template from the "4 Types of Low-cost Air Sensor Projects" table on our Community Science website, and follow the recommended steps below:

1. Conduct background research to determine which pollutants you want to monitor and identify potential sources of the pollutants. Formulate questions about pollutants you may be exposed to, how the levels may vary over time and distance, and where.
2. Outline your experiment and develop a Project Plan. Having a plan will help you to get consistent results. Be sure to include your objectives, background, sampling locations, sampling schedules, and methods.
3. Once your Project Plan is completed, have it reviewed by the Project Leader or Technical Support before the start of the project.
4. Do some research on different low-cost sensors to decide which would be best for your project and budget. Sensors are available for purchase through different websites. For guidance on selecting an air sensor that is appropriate for your specific project goals, refer to the "Resources to Help You Select the Appropriate Low-Cost Sensors" section in the Helpful Links. NJDEP and USEPA plan to establish a sensor loan program in the future. Check for updates on our homepage.
5. Conduct the experiment, following your Project Plan. Note the time, location, and activity occurring when the sensor is collecting data. For comparison purposes, also collect data at a location which you consider to be relatively free of the pollutant(s).
6. Compare the results.
7. While the results may not be precise, you may be able to identify areas with relatively higher levels. You may want to consider changing your routine to reduce your exposure.

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For an example of a Personal Exposure Monitoring project, see the "Project Examples" section of the Helpful Links page.

Type 3: Supplementary Network Monitoring

Level of Effort: High

Low-cost air sensors can be used to supplement network monitoring by focusing on an area outside the range of the network. You may use the data to confirm whether or not local pollutant levels are similar to those at the nearest state-operated monitor.

Supplementary network monitoring projects should meet some acceptable level of **quality control**. For best results, air quality data should be collected for about 1 year, but the minimum amount of time is 3 months, during the time of year when pollution is highest. For guidance on this, see Section 3.1 "What to Look for in a Sensor" in the [Air Sensor Guidebook.](#)

If you are interested in becoming a project manager for this type of project, download a Quality Assurance Project Plan (QAPP) template from the ["4 Types of Low-cost Air Sensor Projects" table](#) on our Community Science website, and follow the recommended steps below:

1. Form a team to carry out the project.
2. Conduct background research about pollutants that may be impacting the area.
3. Think about where in your community you would like to monitor and think about how this will supplement the network. Come up with questions for your project to answer.
4. Outline your study and develop a Quality Assurance Project Plan (QAPP) to answer the project questions you have and plan out quality assurance steps to complete throughout the duration of the project. Having a plan will help you to get consistent results. Be sure to include your objectives, background, sampling locations, sampling schedules, methods, and quality assurance checks.
5. Once your QAPP is completed, have it approved by the Project Leader or Technical Support before the start of the project.
6. Do some research on different low-cost sensors to decide which would be best for your project and budget. Sensors are available for purchase through different websites. For guidance on selecting an air sensor that is appropriate for your specific project goals, refer to the "Resources to help you Select the Appropriate Low-Cost Sensors" section in the [Helpful Links.](#) NJDEP and USEPA plan to establish a sensor loan program in the future. Check for updates on our homepage.
7. Conduct the experiment, following your QAPP. Make note of any changes to the plan and procedures.
8. Analyze the results. Calculate the bias and precision of the data to determine the quality of the data.

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For an example of a Supplementary Network Monitoring project, see the "Project Examples" section of the [Helpful Links](#) page.

Type 4: Hotspot Identification & Characterization

Level of Effort: High

Low-cost air sensors can be used to identify potential air pollution hotspots, where levels may be higher than expected. Because these sensors are typically portable, they can be used in a fixed location or as mobile sensor systems to map pollutants and determine emission sources. The proximity of the sensor measurements to the source is a key factor because the aim is to measure at a location where the pollutant concentrations may be unusually high.

Hotspot monitoring projects should meet some acceptable level of **quality control**. For best results, air quality data should be collected for about 1 year, but the minimum amount of time is 3 months, during the time of year when pollution is highest. For guidance on this, see Section 3.1 "What to Look for in a Sensor" in the [Air Sensor Guidebook](#).

If you are interested in becoming a project manager for this type of project, download a Quality Assurance Project Plan (QAPP) template from the ["4 Types of Low-cost Air Sensor Projects" table](#) on our Community Science website, and follow the recommended steps below:

1. Form a team to carry out the project.
2. Conduct background research about the potential source and potential pollutant(s). Plan to record weather information to determine which way the wind may be carrying pollutants.
3. Determine what air pollutant(s) you would like to monitor and think about where you think they may be coming from, and the areas that may be impacted.
4. Outline your study and develop a Quality Assurance Project Plan (QAPP) to answer the project questions you have and plan out quality assurance steps to complete throughout the duration of the project. Having a plan will help you to get consistent results. Be sure to include your objectives, background, sampling locations, sampling schedules, methods, and quality assurance checks.
5. Once your QAPP is completed, have it approved by the Project Leader or Technical Support before the start of the project.
6. Do some research on different low-cost sensors to decide which would be best for your project and budget. Sensors are available for purchase through different websites. For guidance in selecting an air sensor that is appropriate for your specific project goals, refer to the "Resources to Help You Select the Appropriate Low-Cost Sensors" section in the [Helpful Links](#).
   NJDEP and USEPA plan to establish a sensor loan program in the future. Check for updates on our homepage.
7. Conduct the experiment, following your QAPP. Make note of any changes to the plan and procedures.
8. Analyze the results. Calculate the bias and precision of the data to determine the quality of the data.

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For an example of a Hotspot Identification & Characterization project, see the "Project Examples" section of the [Helpful Links](#) page.