Quality Assurance Project Plan for a Community Science Project:

Air Quality Hotspot Identification Study

Low-cost air sensors can be used for identifying potential air pollution hotspots, where levels may be higher than expected. Since 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.

Section 1: Title and Approval Page

Using _____ Air Sensors to Identify an Air Quality Hotspot in _____

(Name of sensor)

(Location)

Effective Date of Plan: _____

Author(s): _____

This is a "blank" copy of a Quality Assurance Project Plan (QAPP) that can be used for a Community Science air monitoring project. Blank lines with guiding topics in parentheses are meant for you to fill in. Guidance for filling out this document is in the blue boxes, like this one, and can be deleted in your final copy. This is a template and should be altered to accommodate the quality assurance (QA) needs for your specific project. Your QAPP should be approved by the Technical Support, Project Leader, or other designated party before beginning any data collection.

Approvals:

Technical Support: _____
Signature

Project Manager: _____
Signature

This is a general outline to follow for your table of contents. Feel free to add any additional notable sections here.

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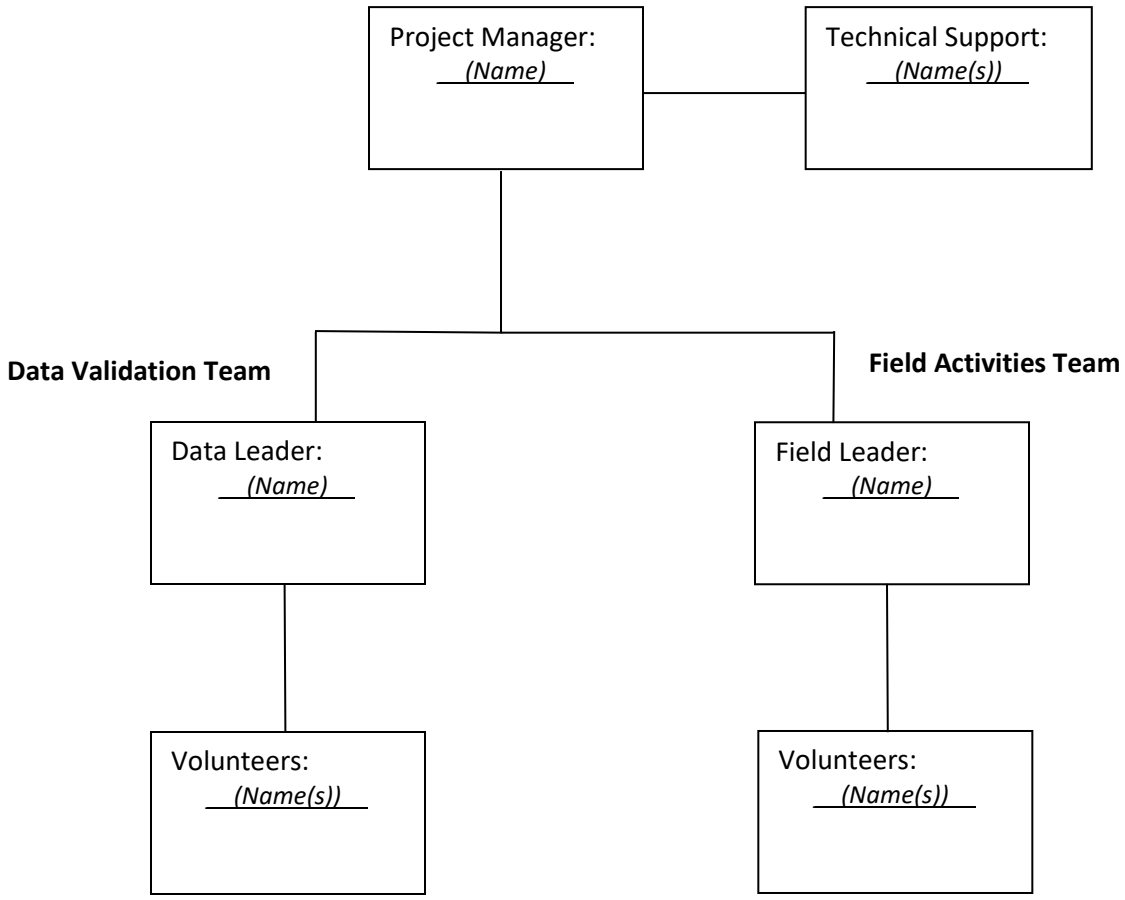
Section 2A: Project Organization Chart

Fill in the organization chart and contact list table, below which shows the lines of communication and reporting for the project.



Section 2B: Project Contact List

Name/Title	Contact Information
(Name) **Project Manager**	Email: Phone:
(Name(s)) **Technical Support**	Email: Phone:
(Name(s)) **Data & Field Leaders**	Email: Phone:
(Name(s)) **Volunteers**	Email: Phone:

Section 3: Project/Task Organization

Listed below are the possible roles needed for a hotspot identification project. Project Manager and Technical Support are critical for this type of project.

Name	Title	Organizational Affiliation	Responsibilities (specific to this project)
(Name)	Project Manager	*(Organization/Group)*	Coordinates between technical support and the interested community group. Oversees project structure, monitor siting, training, technical assistance.
(Name(s))	Technical Support*	*(Organization/Group)*	Supports Project Manager, advises field leader, trains group on proper use of air sensors, advises Project Manager on any data and quality assurance questions.
(Name(s))	Data & Field Leaders	*(Organization/Group)*	**Data:** Train and oversee students and volunteers; assist in technical issues, quality assurance, and data analysis **Field:** Train and oversee student volunteers, assure accuracy of field sampling
(Name(s))	Volunteers	*(Organization/Group)*	**Data and Field:** Collect data, record results, perform data analysis under supervision

*The technical support team could be from government agencies such as the NJDEP Bureau of Air Monitoring or U.S. Environmental Protection Agency (USEPA); professors or experienced students from local universities; or technical professionals. **The technical support team advises the project but is not responsible for its outcome or success.**

Section 4: Problem Definition and Project Objectives

Problem Definition

Describe an air pollution problem, and what initial evidence or circumstances suggest that the levels or air pollution are higher in a specific area (a hotspot). What are the possible sources of the higher levels of air pollution? Do the higher levels occur during certain times of the day, week, or year? The following are examples of a project definition:

In *(location/town)*, there are several sources of air pollution, including *(potential source)* that may not be detected by the closest state-operated monitor. For the purpose of this project, the *(pollutant)* pollution source of concern is *(potential source)*. *(Potential source)* is located in *(location/town)* and may be a potential health hazard for community members as *(pollutant)* can have negative health impacts *(examples of impacts and cite sources)*. *(Pollutant)* can have negative health impacts such as *(examples & cite source)*. This study will collect environmental data using *(type of air sensor)* to measure *(pollutant)* concentrations in *(location/town)* and will be used to answer the following questions:

- "I want to know if *(pollutant)* emissions from *(suspected source)* creating an air pollution problem near my school."
- "I want to know if *(pollutant)* concentrations are higher in one area of town than the other. If so, why?"

Project Objectives

Describe how the project objectives will provide answers to the problem. Include the tasks that will collect information to address the problem. Below are some examples.

- Determine if we should use *(name of sensor)* sensor to measure *(pollutant)* near the source.
- Use *(name of sensor)* sensors to collect data near the source and away from the source to see if concentrations of *(pollutant)* are higher near the source.
- See if *(pollutant)* levels being measured by sensors are a concern.
- Test if *(pollutant)* is measurable at the source.

Data Users

List all the groups/organizations that could make use of the data collected from this project. For example, local schools/universities, community groups, government organizations (NJDEP), etc. Explain how the data could be used and some potential next steps or future projects.

The data users may include:

- Residents of *(town)*
- Students at *(local university)*
- Local *(town)* government

The data and presentation may suggest the following next steps:

- More air quality data may be necessary in order to make confident conclusions.
- Town officials may need to analyze the results and understand the impacts.

Section 5: Background

State where and why this project needs to be done, identifying the reasons for conducting the work and/or the current lack of information relating to the project. Cite sources used here.

(Town) is located in *(specific area of NJ)* with a population of *(town population)*. *(Specific neighborhood)* is located in a(n) *(rural, residential, commercial, or industrial)* part of *(town)* where there is a *(describe the source, i.e., a factory, highway, etc.)* and has the potential to impact local communitys in the area *(add any important things in this area that are impacted like a school, hospital, residential area, high walking traffic, wildlife, etc)*. Ambient air quality data can be collected by the general public using low-cost air sensors and, with the proper oversight, could be used to identify a hotspot source in *(town)*. With the use of *(name of sensor)* we hope to determine whether *(suspected source)* is a local source of *(pollutant)*.

Section 6: Project Location

Select **at least 3** sampling locations: one upwind of the suspected source, one downwind of the source, and one far from the source to act as a control. If possible, create an additional sampling location near a NJDEP air monitor. Provide a description of the sampling locations, and sample dates and times. Provide a map showing the locations and any other relevant information about the area. Tie this information back to the goals and objectives of the project.

(Number, at least 3) sampling locations were chosen in *(town)*. The first sampling site is located *(location)* and is upwind of the potential pollution source. The second sampling site is located *(describe location)* and is downwind of the potential pollution source. The third sampling site is located *(describe location)* and is acting as the control. [If applicable, include this next sentence.] The fourth sampling site is located *(describe location)* and is collocated with the NJDEP air sensor that also monitors *(pollutant)*. Here is a map showing all the sampling locations [insert a map image here with labeled sites and a caption].

Section 7: Project Schedule

In the table below, list all major tasks and activities that will be performed during the course of the project. For a hotspot identification project, it's best to perform air quality data collection for about 1 year, but the minimum time for a data collection period is 3 months, at the time of year when pollution is expected to be highest. Organize this information in the best way that fits you and your project.

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7
Grant writing, project plan/outline, organize group	X						
Grant approval, gather materials, finalize project plans, begin data collection	X	X					
Collect data		X	X	X			
Data analysis		X	X	X	X		
Quality Assurance checks			X	X	X	X	
Report writing				X	X	X	
Presentations						X	X

Section 8: Existing Data

Do some research to find any existing data or previous studies done in your area; or find a similar research topic that could be useful for this current study. Use only data and information from a reliable primary source and cite sources. Explain why this data is relevant to the study and if/how it can be used in the project. Below is an example of how you can describe any existing data.

Existing Data or Study	Data Source	How Data Will Be Used	Acceptance Criteria
(Pollutant) Concentration data in *(units)*	*(Abbreviate source citation here, full citation will be in References section)*	This data will be used to *(briefly state how it will be used, i.e., supplement measured data, compare measured data, show how concentrations have changed)*	This data is relevant because it is the same pollutant measured in the same area from *(time/year)* and has a reliable, peer-reviewed source.

Section 9: Data Quality Indicators

Provide information needed to measure and establish goals for the data quality indicators (DQIs). The goals ensure that the data is accurate, well-managed, and are appropriate for meeting the project objectives. If you need additional resources to help you determine your DQIs or to learn more about what DQIs are and how they are measured, please refer to the Air Sensors Guidebook.

Precision – the ability of a measurement to consistently be reproduced. The goal is a slope of 1.0 ± 0.2, and a correlation coefficient (R^2) > 0.8. There are 2 ways to measure precision:
1) repeated measurement by the sensor of a known concentration such as a standard.
2) repeated measurements of side-by-side sensors.

Precision will be measured by __*(describe how you determined precision)*__ and the goal for percent difference is __*(% difference)*__.

Bias – any influence in the project that might sway or skew the data in a particular direction. The goal is a mean absolute percent difference of ≤ 20. There are 2 ways to measure for bias:
1) challenging the sensor with a known amount of a pollutant that is traceable to a standard.
2) collocating the sensor to a monitor that is traceable to a standard such as state operated monitor.

Bias will be measured by __*(describe how you determined bias)*__ and the goal for percent difference is __*(% difference)*__.

Representativeness – how well the collected data reflects the typical pollutant levels throughout the project area. This can be addressed by describing the 3 sampling locations and their distribution.

The sampling locations are located upwind of the source, downwind of the source, and away from the source to act as a control.

Comparability – the extent to which data from one data set can be compared directly to another data set. State if the data is intended to be compared to other data sets and how this will be achieved.

Data from this study will be compared with _*(describe data from a previous study to be compared to, if applicable)*_ and will also be compared with itself using data from control sampling locations and data from NJDEP monitors. Therefore, this data could be used for comparison in future studies using _*(name of sensor)*_.

Completeness – the amount of data that must be collected in order to achieve the goals and objectives of the project. This can be stated as a total number of samples or a percentage of data collected. The goal is ≥ 75% of valid data. Data is considered valid when collected according to the sensor instruction manual and when it meets the goals of precision, bias, and comparability as explained above.

The data collection period is _*(describe sample collection time)*_ and 75% valid data is the goal.

Sensitivity – the lowest detection limit of a method, instrument, or process for each of the measurement parameters of interest. State the sensitivity needed for the sensor, as stated in the sensor instructions.

The lowest detection limit of the _*(name of sensor)*_ is _*(indicate lowest detection limit with units)*_.

Section 10A: Data Collection Methods

Sampling Design

Describe and justify the data collection activities. Provide information about the frequency of sampling and the collection of quality control (QC) samples. Attach all air sensor instructions as an appendix or provide the web address if they are accessible online.

Sampling Location	Sampling Schedule	Parameter	Field QC Samples	Total Number of Samples	Sampling Location Objective
(Name of location) – Use 1 row for **each** sampling location	Frequency and duration of sampling.	*(Pollutant)*	*(Describe the method & frequency of measuring precision & bias at this location)*	*(proposed # of samples or sampling events)*	Downwind from source
(Name of location)	Frequency and duration of sampling.	*(Pollutant)*	*(Describe the method & frequency of measuring precision & bias)*	*(proposed # of samples or sampling events)*	Upwind from source
(Name of location)	Frequency and duration of sampling.	*(Pollutant)*	*(Describe the method & frequency of measuring precision & bias)*	*(proposed # of samples or sampling events)*	Control site away from source

Section 10B: Equipment List and Instrument Calibration

Equipment List

Generate a list of all necessary field equipment that will be used for the project. Include specific details when listing instrumentation (model and serial number). Make sure the type of air sensor you choose makes sense for a Type 4 project. Refer to "Resources to Help You Select the Appropriate Low-Cost Sensors" page in the Helpful Links.

Materials
(type of air sensor & serial #)
(type of air sensor & serial #)
(type of air sensor & serial #)
Pens
Data sheets

Instrument Calibration and Maintenance

In the table below, fill in any calibration or maintenance requirements for the equipment used during the project. State how the calibration information will be documented.

Instrument	Dates & Times	Were calibrations within acceptance criteria?	Maintenance Requirements
(Name of sensor and serial #)	*(Dates & times of how often this was done)*	*(Yes or no)*	As per manufacturer's instructions

All calibrations were completed as needed/recommended by the instrument instruction manual.

Section 11: Field Data Table

Below is an example of a field data table. If the data is being collected and recorded electronically, provide an example of the format of the data, in a spreadsheet or text table.

Using *(name of sensor)* to Identify an Air Quality Hotspot in *(town)*				
Group:				Sensor Serial Number:
Date	Sampling Location	Start Time	Stop Time	Additional Observations (i.e. area description, weather, what's nearby, anything physically sensed like smell or visible smog)

Section 12: Training and Specialized Experience

Training

Describe any training needed by an individual involved with the project. Also include any refresher training that may be conducted during the project. An example is below.

Personnel/Group to be Trained	Description of Training	Frequency of Training
- Project Manager - Data & Field Leads - Participants	Training session will be led by Technical Support on how to properly use air sensors, collect data, analyze data, and complete QAPP.	One large group-setting training, and then as needed throughout the duration of the project.

Specialized Experience

Identify who is providing training to the community science group for the low-cost sensors, data analysis, quality assurance, etc. This will typically be the same person/people who are considered the Technical Support. Also state their relevant experience and years of experience. Below is an example table you can fill in.

Person	Specialized Experience	# of Years of Experience
(Names of people providing technical support)	They have experience in air monitoring including *(pollutants)*.	*(# of years)* years

Section 13: Assessments and Oversight

In order to identify shortcomings and deviations from the QAPP, plan out some assessments of the sensors and the filed & data work performed by the Field Operations and Data Validation Teams. For each type of assessment, describe the procedures for handling QAPP and project deviations encountered during the project assessment. Below is an example of a table showing some general assessments. Feel free to use this example and fill it in with your more specific oversight & assessment plans.

Assessment Type	Frequency of Assessments	What is Being Assessed	Who Will Conduct the Assessment	How Issues or Deviations will be Addressed
On-site field inspection	During each sample	Air sensor operation, field data sheet completeness and correctness, data analysis, quality assurance	Data & Field Leads, Project Manager, Technical Support	Retrain if necessary
Performance	Once	Accuracy of air sensors	Technical Support or 3rd party	Determine validity of data

Section 14: Data Management

Describe the data management processes used throughout the project, including recording and transcribing field notes, logging and retrieval of instrument data, and data analysis. Describe the way data handling errors will be managed (e.g., spot checks for transcription and calculation errors). If the data is recorded electronically, describe how it is stored, and if additional calculations are performed on the data.

Field Data and Air Sensor Data:

All data from the field will be recorded on pre-printed data sheets (Section 11). The recorded data will be checked for accuracy and transcription errors by the Data and Field Leads and/or Project Manager. If there are any discrepancies in data entries, Data and Field Leads and/or Project Manager will discuss them with the Volunteers. Original datasheets will be kept until after the final project reporting is completed. Data from air sensors will be downloaded and manipulated using __*(data analysis program used)*__ and original raw data will be kept on file in case of discrepancies or errors. The data will be electronically stored in __*(location of data)*__. The following calculations will be performed to calculate __*(resultant being calculated)*__ : __*(list calculations with appropriate units)*__.

Section 15: Data Review for Usability

List the types of checks that will be performed at the end of the project to determine if the data collected is usable for achieving the goals of the project. Below is an example of some Field/Lab and Data checks you may complete.

Field/Lab	Data Management
• Monitoring performed per sensor instructions or QAPP • Field QC samples performed correctly • Measurements performed correctly • Calibrations performed correctly • Data meets acceptance criteria • Holding times • Evaluate any deviations from QAPP or sensor instructions to determine the impact to the data and project objectives	• Data entry and transcription errors • Calculation/reduction errors • Proper data and document storage • Missing data documented • *(Explain how data meets acceptance criteria)* • *(How long raw data is kept)* • *(Explain any deviations from QAPP or sensor instructions)*

Explain the usability of your project data. If your data review meets all QC criteria, then your data will be assumed to be usable for the intended project objective. If that is not the case, explain which data can be used if not all criteria have been met. The paragraph below is an example.

All data issues identified will be discussed with the Project Manager or Technical Support to determine data usability on a case-by-case basis. All decisions to allow data that did not fully comply with QC criteria or QAPP requirements will be explained, and any resulting limitations on data use will be fully discussed in the final project presentation.

Section 16: Reporting

Specify the frequency of all project reports, the names of the originators and to whom they will be issued. This may include but is not limited to the following: sample collection records, quality control sample records, equipment calibration records, assessment reports, data downloading reports, final report of results, etc. Below is an example.

During the sampling period, the Project Manager will email weekly project reports to Technical Support in order to provide a status update for the project and will include a summary of the quality assurance data checks conducted and the results of those checks. *(Also include any final presentations done with the data for school projects, local meetings, etc.)*.

Section 17: References

List any references that were used in any previous sections. This can be added as an Appendix if it's long.