Quality Assurance Project Plan

for

Community-Led Improvement of Air Quality and Health in the Lower Mystic (CLEANAIR)

Prepared by

John L. Durant, PhD, P.E.

30 August 2023

Section A. Project Management Elements

A1 Title and Certification Page

Plan Title:	Community-Led Improvement of Air Quality and Health in Lower Mystic (CLEANAIR). Project Grant # 00A01109
Prepared by:	John Durant
Organization:	Mystic River Watershed Association (MyRWA)
Effective Dates:	August 2023

I certify that I have read and understood the full contents contained herein.

Project Manager / Primary Contact:

Name:	Neelakshi Hudda	**Phone:**	323-428-1148
Signature:		**Date:**	August 30, 2023

Project Supervisor:

Name:	Patrick Herron, Executive Director	**Phone:**	781-316-3438
Signature:		**Date:**	August 30, 2023

Project QA Manager:

Name:	John Durant	**Phone:**	781-733-0539
Signature:		**Date:**	August 30, 2023

US EPA Project Officer:

Name:	Liam Numrich	**Phone:**	
Signature:	LIAM NUMRICH Digitally signed by LIAM NUMRICH Date: 2023.09.07 12:30:59 -04'00'	**Date:**	

US EPA Technical Reviewer:

Name: Alysha Murphy **Phone:** ____________

Signature: ALYSHA MURPHY Digitally signed by ALYSHA MURPHY Date: 2023.09.06 06:47:59 -04'00' **Date:** ____________

US EPA QA Reviewer:

Name: Elise McNally **Phone:** ____________

Signature: ELISE MCNALLY Digitally signed by ELISE MCNALLY Date: 2023.09.05 05:05:58 -04'00' **Date:** ____________

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A3 Distribution List

The individuals and their respective organizations listed in Table A3.1 will hold copies of the approved Quality Assurance Project Plan (QAPP).

TableA3.1. QAPP Distribution List

Project Role	Name, Title, Organization, Telephone, Email
QAPP Development Leader	John Durant, Air Quality Engineer, 781-733-0539, 5646durant@gmail.com
Project Manager	Neelakshi Hudda, Air Quality Scientist, 323-428-1148, neelakshi.hudda@tufts.edu
Field Coordinator	Neelakshi Hudda, Air Quality Scientist, 323-428-1148, neelakshi.hudda@tufts.edu
QA Manager, responsible for distributing the QAPP	John Durant, Air Quality Engineer, 781-733-0539, 5646durant@gmail.com
Project Supervisor	Patrick Herron, Executive Director, Mystic River Watershed Association, 781-316-3438, patrick.herron@mysticriver.org
EPA Project Officer	Liam Numrich, US EPA, numrich.liam@epa.gov
QA Reviewer	Elise McNally, US EPA, mcnally.elise@epa.gov
Technical Reviewer	Alysha Murphy, US EPA, murphy.alysha@epa.gov

A4 Program Organization and Task Responsibilities

The roles and responsibilities of specific individuals working on this project are listed in Table A4.1.

Table A4.1. Personnel, Project Role and Responsibilities

Personnel name and title	Project Role	Responsibilities
John Durant, Air Quality Engineer	QAPP Development Leader	QAPP creation in coordination with all other roles.
Neelakshi Hudda, Air Quality Scientist	Project Manager	Primary contact. Manages field coordinator. Produces project data and reports and works with QA manager to develop QC report.
Neelakshi Hudda, Air Quality Scientist	Field Coordinator	Coordinate field activities. Perform field activities as needed. Ensures field procedures are properly followed and performs QC checks to confirm or correct procedures as needed.
To be hired	Field Technician	Perform field activities (setup and maintain monitors, data retrieval and storage)
	Community Advisory Board	Advise Project Manager and Supervisor on monitoring project selection, prioritization and design
John Durant, Air Quality Engineer	QA Manager	Verify QA procedures. Reviews project data and QC reports to ensure that project follows QA measures. Perform field activities as needed.
Patrick Herron, Executive Director, Mystic River Watershed Association	Project Supervisor	Executive oversight of project. Oversees all aspects of project including fiscal management, project objectives, data uses, program changes, etc.

A5 Problem Definition/Background

Our project comes at a time when communities have access to American Rescue Plan Act (ARPA) funding, which can be used for infrastructure improvements. Thus, this project can help municipalities by better informing decisions to seek ARPA funds for environmental improvements that community members want to see and will thereby improve resident quality of life.

Combined, our four communities have a population of ~200,000, cover ~15 square miles, and are situated at the core of the metropolitan Boston's industry, commerce, and transportation infrastructure (supporting its airports, shipyards, and highways). These communities contain linguistically isolated populations dominated by people of color. These communities experience health disparities and poor air quality and were identified by Massachusetts as among the hardest hit by COVID.[1,2]

These four communities have a long history of intense industrial use and bear a disproportionate legacy of water and soil contamination compared to other communities in the Boston area (https://mysticriver.org/pollution). There are metal recycling facilities, a 20-MW power plant, a liquid natural gas processing facility, airport parking and freight forwarding companies, boat salvage and repair facilities, construction junk yards and self-storage buildings. A dominant land-use feature in these communities is dedicated to support regional transportation infrastructure including highways, commercial waterways, railroads, and a major airport (Logan International Airport). For example, Chelsea Creek is the storage hub for 80% of New England's heating fuel, road salt for more than 300 cities and towns, and 100% of the jet fuel used at Logan. Many residents of Everett, Malden, Charlestown, and East Boston live near roads with high levels of vehicle emissions. According to the Pollution Proximity Index (PPI) – developed by the Metropolitan Area Planning Council (MAPC) – 34% of residents in Greater Boston live in areas with the highest PPI scores. Furthermore, the burden of proximity to pollution is distributed unequally along lines of race and ethnicity, with over 45% of Black and Asian residents and over 50% of Latino residents living in areas with the highest PPI scores compared to less than 30% of White residents.

The goal of our project is to improve air quality and health in communities in the watershed that are most burdened by transportation-related air pollution and disease. By deploying networks of air pollution monitors at community-identified locations in each of four cities, we will provide actionable data and information to increase community awareness, inform decision-making around transportation infrastructure, and reduce exposures to harmful transportation-related particulate air pollutants including PM10 (particulate matter ≤10 microns), PM2.5 (particulate matter ≤2.5 microns), and ultrafine particles. Through a 12-member Community Advisory Board (CAB) and extensive surveying and public engagement, the team will build capacity among residents who have been disproportionately impacted by poor air quality.

A6 Project Description and Timeline

Because long-term air quality data have not been systematically collected and made publicly available in the four communities, it is essential to collect data at the local scale to begin informed engagement with community members. Our monitoring program will have two complementary parts running in parallel: in the first we will develop a monitoring network across the four Lower Mystic communities (henceforth, Lower Mystic Network; LMN), and in the second we will perform a set of projects - one in each community - that are highly responsive to community concerns (henceforth, Lower Mystic Community Projects; LMCP).

Lower Mystic Network (LMN). We will deploy a network of stationary monitors to measure PM2.5, PM10 and ultrafine particles with one station in each of our four partner communities. The goal is to provide long-term data (i.e., months, seasons, years) for engagement with communities and to complement data collected with the LMCP. LMN sites will be located at least 150 m from the nearest busy street and other known sources of particulate air pollution (e.g., restaurants) so that the resulting measurements generally

[1] US EPA, Environmental Justice Screening tool, Ejscreen.epa.gov/mapper/, accessed June 2022.
[2] Massachusetts Department of Public Health Covid-19 Database, https://www.mass.gov/info-details/archive-of-covid-19-cases-in-massachusetts, accessed June 2022.

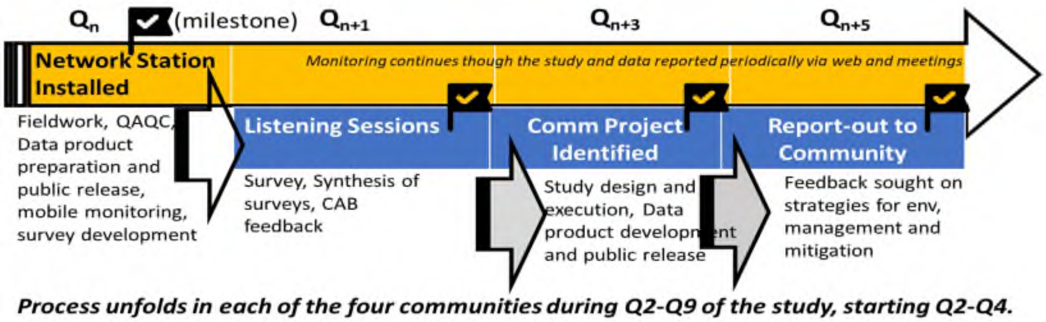


Figure A6.1. Graphical representation of the work and process in each community.

reflect local background concentrations. Monitoring will begin in the second quarter of the project in all four communities and continue through the end of year 3.

Lower Mystic Community Projects (LMCP). LMCPs will focus on (1) quantifying air quality impacts at spatial scales associated with transportation-related air quality concerns (airport, highways, trucking/cargo facilities, idling violations, congestion) in the communities and (2) providing actionable data. We will quantify impact relative to the local background, which will be determined with fine scale monitoring across the community and using the LMN data. Within each community, monitoring will be conducted at 5-7 locations (minimum = 5). All 5-7 sites will be equipped with PM2.5 and PM10 monitors and 3 of the 5-7 sites will be equipped with condensation particle counters (CPC) for ultrafine particle measurements. These projects will engage the CAB and the community in site selection, monitoring, data interpretation and communication of results. Monitoring site location selection will be guided by responses to questions on the community survey (a draft of the survey is provided in Appendix A). The surveys will be distributed by the CAB to members of their respective communities via email.

This is a three-year project; it began on April 1, 2023. The timeline of work in each community is shown in Figure A6.1. Milestones by quarter are identified in Table A6.1, which also lists major tasks. Overall project management tasks will occur regularly (weekly, monthly, or quarterly). A map showing the four communities is shown in Attachment B. In the coming weeks, as the citing process continues to take shape within Project Team and CAB discussions, an updated version of this map will be generated showing possible locations of the monitoring sites. The updated map will be added to a new version of the QAPP and shared with EPA.

Table A6.1. Major tasks, timeline of work and a Responsible, Accountable, Consulted and Informed (RACI) matrix for all project partners and personnel.

Project Task	36 month schedule in quarters	MyRWA	CHA	AIR Inc.	STEP	Tufts	Durant	Hamilton	Spindle-Jackson	COE, COM
Management										
Management	Q1-12	R								
Project Meetings	Q1-12	R	C	C	C	C	I	C	C	I
Reporting (quarterly & final)	Q1-12	R	C	C	C	C		C	C	I
Project website* and data stream maintenance	Q2-Q12	R	C	C	C	C	I	I	I	I
Air Quality Monitoring										
Select monitoring network locations*	Q1	R	C	C	C	C	C	I	I	C
Install and run network sites*	Q2-Q12	A, R	I	I	I	R	R	I	I	C
Identify* and design community projects	Q3-Q6	A	C	C	C	R	R	C	C	C
Conduct and report-out* community projects	Q4-Q9	A, R	I	I	I	R	R	I	I	I
Data QAQC and public release	Q2-Q12	A, R				R	R			
Data Interpretation	Q2-Q7	A,R	C	C	C	R	R	C	C	
CAB										
Develop CAB Structure, Charter, Payment and Applicati	Q1	A	C	C	C	C	C	R	R	C
CAB recruitment	Q1-Q7	A, R	C	C	C	C	I	R	R	C
CAB Quarterly meetings	Q1-12	A,R	I	I	I	I	I	R	R	I
Engagement										
400 surveys*	Q3-Q9	A	C	C	C	C	I	R	R	C
Listening Sessions*	Q3-Q9	A	C	C	C	C	I	R	R	C
Data reports & communications tools	Q8-Q12	A	C	C	C	I	I	C	C	I
Report-Out sessions* & public events	Q8-Q12	A	C	C	C	I	I	R	R	C
Mitigation										
Stakeholder meetings	Q1, Q9, Q11	A	C	C	C	I	I	I	I	C
Develop mitigation strategies	Q3-Q12		C	C	C	C	I	I	I	C
A: Accountable; R: Responsible; C: Consulted; I:Informed; *major milestones										

A7 Data Quality Objectives

High frequency continuous data will be collected. The primary users of the data will be the community organizations, as represented by the CAB. It is also possible that the data may be of interest to the municipalities, state organizations such as the Massachusetts Department of Environmental Protection (MA DEP), Massachusetts Department of Conservation and Recreation (MA DCR), and Massachusetts Department of Transportation (MA DOT) as well as federal organizations such as United States Environmental Protection Agency (US EPA).

Requirements for ensuring that the data are of suitable quality for their intended purpose include accuracy, precision, representativeness, comparability, completeness, and sensitivity defined as:

Accuracy	The extent of agreement between a measured value and the true value of interest.
Precision	The extent of mutual agreement among independent, similar, or related measurements.
Representativeness	The extent to which measurements represent true systems.
Comparability	The extent to which data from one study can be compared directly to similar studies.

Completeness	The measure of the amount of data acquired versus the amount of data required to fulfill the statistical criteria for the intended use of the data.
Sensitivity	The extent to which the reporting limits of each monitoring instrument are less than the action limits for the project.

Quality indicators and criteria for acceptance for this project are listed in Table A7.1 and described below. Details of how these criteria are met for each component of the program's monitoring tasks are presented in Section B5.

To ensure **precision** and **accuracy,** the CPCs and $PM_{2.5}$ monitors will be laboratory-tested before deployment (flow measurement and zero-air tested) and recalibrated annually as recommended by the equipment manufacturer. Twice a year, lab testing will be performed involving side-by-side comparison of the CPCs and side-by-side comparison of the $PM_{2.5}$ monitors to make sure they are reading approximately the same value (+/- 10%). We will also run our $PM_{2.5}$ monitors at a nearby MA DEP monitoring site (Chelsea, MA; 025-0025-1004, Federal Equivalent Method (FEM) PM2.5 monitor) to get a cross comparison between our instruments and federal reference instruments. **Representativeness** will be assessed in each outdoor monitoring location to make sure that the air is relatively well-mixed with regard to particulate air pollution. **Completeness** refers to the amount of valid data compared to the total amount of data collected. The data set will be complete if 90% meets all the other established criteria (precision, accuracy, representativeness, comparability). **Comparability** will be qualitatively evaluated by comparing our results with previous urban air quality studies involving particle number concentration (PNC) and $PM_{2.5}$ measurements.

Table A7.1. Data Quality Indicators (DQIs) and Acceptance Criteria (Performance Goals)

Parameter - Method	Units	Sensitivity[1]	Accuracy[2]	Overall Precision (RPD)[2]	Approx. Expected Range[1]
PM2.5 - continuous monitor	$\mu g/m^3$	1 ug/m^3	+/- 2%	5%	4-50 $\mu g/m^3$
PM10 – continuous monitor	$\mu g/m^3$	1 ug/m^3	+/- 2%	5%	40-120 $\mu g/m^3$
Ultrafine particles – continuous monitor	part./cm^3	500 particles/cm^3	+/- 10%	10%	2,000-100,000 particles/cm^3

[1]Based on experience with the two instruments (Dylos DC1700-PM PM2.5/PM10 and TSI Condensation Particle Counter for particle number concentration).

[2]User Manual DC1700-PM Air Quality Monitor, Dylos Corporation, Riverside, CA, DC1700PM Users Manual 01.pdf. https://lib.store.turbify.net/lib/yhst-16473542037836/DylosLoggerUsersGuidev30.pdf.; Environmental Particle Counter™ Monitor Model 3783, Operation and Service Manual, P/N 6003653, Revision E, September 2015; https://home.iiserb.ac.in/~ramyasr/files/Manuals/EPC.pdf.

At the close of the project, the QA Manager will produce a report detailing how the resulting dataset compares with these data quality indicators. This review will include, for each parameter, calculation of the following:

- Percent of samples exceeding Accuracy and Precision limits.
- Average departure from Accuracy and Precision targets.
- Overall percent of samples passing QC tests vs. number proposed in Table A7.1 (Completeness).

After reviewing these calculations and taking into consideration such factors as clusters of unacceptable data (e.g., whether certain parameters, sites, dates, equipment issues, etc., produced poor results), the Project Manager and/or QA Manager will evaluate the overall attainment of data quality objectives and determine what limitations to place on the use of the data, or if a revision of the data quality objectives is allowable. This finding will be included in the final Data Quality Statement (see Sections A9 and D2).

A8 Training Requirements

Training on all aspects of project data collection and management will be provided to project participants by the Project Manager and will be documented—including trainer(s), dates of training, and subject matter—in a Training Log. All participants should be familiar with this QAPP, its Standard Operating Procedures (SOPs), and with the manufacturer instructions for the monitoring equipment.

This project will not require any training of volunteers.

A9 Documentation and Records

A9.1 Documentation

Paper field sheets will be used for recording deployment and retrieval of data. All notes will be made in permanent ink, initialed, and dated, and no erasures or obliterations will be made. Table A9.1 details record handling procedures for this project, including the content of the final Data Quality Statement (also see Section D2).

Table A9.1. Record Handling Procedures

Activity	Details
Field Sheets	Field sheets will be filled out for each visit to the monitors in the field (deployment, data retrieval, or monitor retrieval). The field sheets will be stored in hard-copy form in the MyRWA office.
Data Generation and Storage	All data downloaded from the monitors will be recorded electronically onto computer storage media. Each file will be saved with a filename that references the location and the end dates of the recording. All files will be stored in an unedited version in addition to the working version. Data edits or calculations will only be made in the working version. Data will be archived in electronic form by MyRWA. Electronic copies will be backed up either on the cloud or on a dedicated hard drive.
Data Quality Report	The final project report will include the following components: Reference to the project QAPP, Summary of Corrective Actions, and a data evaluation summary signed by

Activity	Details
	the Quality Assurance (QA) Officer. The data evaluation summary will detail how the resulting dataset compares with the program's data quality objectives. It will include an analysis of pre-and post-monitoring calibration data, and a calculation of Data Quality Indicators for comparison to the Data Quality Objectives. The Project Manager and the QA Officer will evaluate attainment of data quality objectives. They will determine if limitations need to be placed on data use, or whether a revision of the data quality objectives is necessary.
Reporting Format	Any status reports, final reports or data quality reports associated with the project will be in a digital format (e.g., MS Word or PDF). Data will be formatted using excel-based templates.

A9.2 Field Records

Field Data Sheets will provide the primary means of recording the monitor deployment and data retrieval activities (Table A9.2). Data sheets to be used for this project are listed in the table below; sample data sheets are attached in Attachment C.

Table A9.2. Project-Specific Datasheets, Labels, and Forms for All QAPPs

Form Name	Description
Field Data Sheet	Used to record regular visits to the monitoring sites: site location and ID, crew names, time of data retrieval, condition of instruments, maintenance activities.
Instrument Calibration Log	Used to document maintenance, pre- and post-field monitoring, calibration, and testing of the equipment.

Section B. Data Generation and Acquisition

B1 Monitoring Process Design (Experimental Design)

Because long-term air quality data have not been systematically collected and made publicly available in the four communities, it is essential to collect data at the local scale to begin informed engagement with community members. Our monitoring program will have two complementary parts running in parallel: in the first we will develop a network of long-term monitoring stations across the four Lower Mystic communities (henceforth, Lower Mystic Network; LMN), and in the second we will perform a set of projects in each community that are highly responsive to community concerns (henceforth, Lower Mystic Community Projects; LMCP).

B1.1 Long-term Monitoring Sites

Lower Mystic Network (LMN). We will deploy a network of stationary monitors to make continuous measures of PM2.5, PM10, and ultrafine particles in outdoor air with at least one station in each of our four partner communities (Malden, Everett, Charlestown, East Boston). The goal is to provide long-term data (i.e., months, seasons, years) for engagement with these communities and to complement data collected through the LMCP (see next section). Monitoring will begin in Q2 in all four communities and continue through the end of the study. One of the goals of the LMN is to better understand background contributions to air pollution in the four communities; therefore, particular care will be taken in selecting LMN sites so that they are as far as possible from known sources of air pollution (i.e., at least 150 m from busy streets and other known sources of particulate air pollution).

B1.2 Short-term Monitoring Sites

Lower Mystic Community Projects (LMCP). LMCPs will focus on measuring outdoor air quality impacts at spatial scales associated with local sources of transportation-related air pollution (airport, highways, trucking/cargo facilities, idling violations, congestion) in the communities. We will quantify impacts relative to the local background, which will be assessed using the LMN data. Within each community, monitoring will be conducted at 5 to 7 locations (all sites with PM2.5 and PM10 monitors and up to 3 sites at a time with ultrafine particle monitoring). Monitoring will be performed at these sites for different lengths of time depending on the nature of the pollution problem identified by the CAB. Monitoring for PM2.5 and PM10 will be performed for a minimum of 1 month at each site; ultrafine particles will be measured for approximately 1 week at each site where PM2.5 and PM10 are also being monitored (the CPCs will be rotated throughout all sites during the campaigns).

B1.3 Monitoring Site Selection

LMN monitoring sites will be selected by Tufts University air quality scientist, Dr. Neelakshi Hudda, with the input of project team partners (MyRWA, Cambridge Health Alliance, AIR inc., and Somerville Transportation Equity Partnership). Selection of LMCP monitoring site locations will be performed based on the input from the CAB. The aims of the monitoring are to make measurements that meet our DQOs and are responsive to community needs for air quality information. Thus, it is essential to have the participation of both an experienced air quality scientist and community input in the site-selection process. Some of the other site-selection criteria we will consider include site accessibility, safety, security, and availability of electricity. For both LMN and LMCP sites, requirements for site selection will include (i) 24/7 availability of 120-V (15 or 20 Amps) AC electricity, (ii) adequate air flow away from vegetation and other obstructions (walls, fences, buildings), (iii) 24/7 site access by the field team, and (iv) site security (e.g., behind a locked gate, within someone's property boundaries, on top of a flat roof, etc.). The equipment will be housed within a weather-proof, air conditioned (cooled in summer, heated in winter) rectangular shelter (6 feet long x 2 feet wide x 2 feet high) made of durable plastic on which a key or combination lock can be placed. The air inlet will be placed at least 2 feet (61 cm) above the ground surface. The final locations will be documented and mapped by the Project Manager. The QA Manager will incorporate these materials into a new version of the QAPP, and then send the new QAPP to the EPA.

B1.4 Monitoring Equipment

To monitor PM2.5 and PM10 we will use Dylos DC1700-PM PM2.5/PM10 air quality monitors, and to monitor ultrafine particles we will use TSI 3783 condensation particle counters. We have used these instruments before in previous studies and have found them to be reliable and capable of allowing us to meet our data quality objectives. Both instruments require 120-V AC (wall power) to operate; the Dylos instruments can run on internal batteries for 6 hours as a temporary backup should the wall power be disrupted.

B2 Sampling Methods

This program is only collecting *in situ* measurements of particulate air pollution in ambient air. No sample collection or storage will be performed.

Monitoring equipment will be calibrated prior to field use in accordance with the manufacturer's instructions manual as described in Sections B7.1. Calibration will be documented on the Instrument Calibration Log and the Field Data Sheets (samples attached). PM2.5 and PM10 measurements will be recorded every 5 minutes; PNC will be recorded every second.

B3 Sample Handling and Custody

This project does not involve sample handling.

B4 Analytical Methods

In situ parameters measured using factory-calibrated monitors do not require analytical methods.

B5 Field Quality Control

The monitoring program will include appropriate field QC tests to assess the general performance of the instruments as well as basic data quality issues (as best as can be determined in the field).

B5.1 Side-by-side Comparison

See the attached SOP (Attachment D) for a description of this procedure.

B5.2 Reference Site Comparison

The PM2.5 monitors will be periodically collocated at the nearest MA DEP air quality monitoring station that measures PM2.5 (Chelsea, MA; 025-0025-1004, FEM PM2.5 monitor) to check for data comparability. Each monitor will be collocated at this site for at least one week per year for each year of the study. See the attached SOP (Attachment C) for a description of this procedure.

B5.3 Field Checks

Field checks will be performed on a weekly basis and will include data download and checking the weekly record for completeness as a measure of instrument performance. Other field checks will include time drift corrections (relative to NIST.gov), flow measurements with a factory-calibrated flow monitor (TSI 4100 flow meter[3]), zero concentration checks (inline HEPA filter), and noting any error flags displayed by the instruments.

B6 Instrument/Equipment Testing, Inspection and Maintenance

All equipment will undergo periodic maintenance and calibration verification according to the schedule in Table B6.1. These activities will be performed by the manufacturer or by the QA Officer or Field Coordinator as indicated in Table B6.1. These procedures will be documented by date and the signature of the person performing the inspection. All instrumentation will be maintained in good repair as per the manufacturer's recommendations to ensure proper function.

Records of equipment inspection, maintenance, repair, and replacement will be kept in a logbook, along with standard operating procedures for instrument maintenance and calibration.

Table B6.1. Typical Instrument/Equipment Inspection and Testing Procedures

Equipment	Inspection frequency	Type inspection (acceptance criteria)	Maintenance, Corrective Action	Person (Role) Responsible
PM2.5/PM10 monitor	Before each use At each data retrieval (weekly)	Calibration (certificate of calibration provided by manufacturer) Instrument status indicators[1] (no error messages)	Cleaning; repair/recalibration by manufacturer.	Field Coordinator
Condensation particle counter (CPC)	Before each deployment At each data retrieval (weekly)	Calibration (certificate of calibration provided by manufacturer); Flow test at inlet (3 LPM); Zero-air check (<100 #/cm^3). Instrument status indicators[2] (no error messages)	Wick replacement; repair/recalibration by manufacturer. Change wick. Refill water bottle with deionized water. Bring CPC back to lab if in need of repair.	Field Coordinator

[3] https://tsi.com/products/flow-meters,-flow-sensors,-and-flow-analyzers/4000-series-analog-and-digital-flow-meters/mass-flow-meter-41401/

[1]User Manual DC1700-PM Air Quality Monitor, Dylos Corporation, Riverside, CA, DC1700PM Users Manual 01.pdf. https://lib.store.turbify.net/lib/yhst-16473542037836/DylosLoggerUsersGuidev30.pdf.
[2]Environmental Particle Counter™ Monitor Model 3783, Operation and Service Manual, P/N 6003653, Revision E, September 2015; https://home.iiserb.ac.in/~ramyasr/files/Manuals/EPC.pdf.

B7 Instrument/Equipment Calibration and Frequency

B7.1 Pre-measurement Instrument Calibration and Checks

Field instruments will be factory calibrated prior to the start of the project and annually thereafter and documented in instrument calibration logs (i.e., calibration certificates will be stored in the logbook).

Side-by-side experiments will be conducted in the laboratory prior to the start of and at the end of field deployments to assess instrument differences (comparability). These experiments will be performed by placing the instruments side-by-side on the same laboratory bench and running them simultaneously for 3-4 hours while recording the measurements.

If there are any deviations between the before and after checks that exceed the DQO listed above, then the discrepancies will be reviewed with the QA Manager.

B7.2 Instrument/Equipment Inspection, Testing Procedures

Equipment maintenance will be conducted routinely. Records of equipment inspection, maintenance, repair, and replacement will be recorded in a logbook.

The wicks on the water-based condensation particle counters will be replaced every three weeks or more frequently if necessary. After the wicks are changed, air flow rate through the CPCs will be measured with a factory-calibrated flow monitor (TSI Model 4140), and a zero-air check, or negative control, will be performed – specifically, a HEPA filter will be placed over the CPC inlet, which should result in a measurement of ~0 particles/cm^3 of air. The results of the flow and zero-air checks will be recorded on the field data sheets. The Dylos DC1700-PM monitors will be cleaned of dust accumulation by blowing clean compressed air into the top vents. The cleaning will be performed monthly.

B8 Inspection/Acceptance of Supplies and Consumables

This project does not involve sample collection; all data is collected with *in situ* fixed (stationary) monitors. Except for replacement wicks for the CPCs, this project does not involve use of field consumables. Wicks will be replaced approximately every 3 weeks or more frequently as needed.

B9 Non-direct Measurements

This project relies on the following secondary data:

- Data based on measurements made at MA DEP sites in the Boston area (e.g., PM10 and PM2.5 from the Roxbury Harrison Avenue site (25-025-0042) and PM2.5 from the Chelsea site) will be obtained from Airnow.gov. This data will be used to test comparability with the data we collect from the four communities.
- Air temperature, relative humidity, wind speed and wind direction data will be acquired at 1-minute time resolution from the National Weather Service station at Boston Logan International

Airport (KBOS) (NOAA National Centers for Environmental Information). This data will be used to help interpret air pollution patterns observed in our data.

B10 Data Management

Data management will occur using a relatively simple linear process: data collected by the instruments will be downloaded in the field, transferred to secure storage in the office, and then processed (i.e., quality-controlled), analyzed, interpreted, and reported – in that order.

B10.1 Process and Procedures

Data will be downloaded from the monitors to a laptop computer in the field on a weekly basis. Each time the sensors are visited the field technician will record the date, time, condition of the instrument, data display (if visible), the time of data upload, and the time the logger is relaunched on the field sheet (see sample field sheet in Appendix B). Prior to relaunching data collection, the technician will confirm that the clock on the monitors is synchronized with local time and will note the time differential (between local NIST time and the time on the monitors) on the field datasheet. After returning to the office, the times in the uploaded data file will be compared to the times on the field sheet to confirm that the monitor's internal clock is maintaining the correct time.

B10.2 Data Handling

Upon copying the raw data files to the laptop in the field they will be given unique filenames that include the monitoring-site location, parameter, and date of download (e.g., Everett_PM2.5_093023). After returning to the office, the collected datafiles will be transferred from the laptop to a secure drive or the Cloud. The raw datafiles will then be copied, and data processing will occur on the copied files. All raw datafiles will be preserved for the duration of the project on the secure drive or the Cloud.

As part of the quality-control process, the raw datafiles will be inspected manually, making sure that time periods are not duplicated or missed, and measurements marked with error flags by the monitors are removed or censured depending on the nature of the error. In addition, the timestamps in the raw datafiles will be compared to the field datasheets to make sure there is one-to-one correspondence. A backup copy of the quality-controlled datafiles will be stored permanently on the secure drive or the Cloud. Data analysis and interpretation will only be performed using the quality-controlled datafiles. Secondary data from MA DEP and NOAA will be quality checked and processed using these same procedures.

Only Windows-based laptops and personal computers will be used for the project. All data processing and analysis (including both primary and secondary data) will be performed using up-to-date versions of ArcGIS, R, Matlab, and Excel software.

B10.3 Management Requirements

The data will also be used internally to inform the CAB, local municipalities, and other interested stakeholders about air quality in the Lower Mystic. Documentation of data recording and handling, including all problems and corrective actions, will be included in all preliminary and final reports. See Section A9 for record handling and storage procedures.

Section C. Assessment and Oversight

C1 Assessments and Response Actions

This section identifies the number, frequency, and type of planned assessment activities that will be performed to ensure implementation of this QAPP. These activities will be overseen by the Project Manager in consultation with other team members as necessary.

C1.1 Assessments

Field Procedure Audit

The QA Manager in coordination with the Field Coordinator will be responsible for verifying that field procedures and measurements are properly followed. The field audit checklist will be performed annually and include examination of the following:

- Field records
- Adherence to this QAPP
- QA procedures

Results of field audits will be documented in QA reports to the Project Manager (Section C2).

Laboratory Audits

This project does not include analytical laboratories.

Data Audits

Data will be audited under the direction of the QA Manager as part of the data validation process (Section D1). Raw data will be reviewed for completeness and proper documentation.

C1.2 Assessment Findings and Corrective Action Responses

The Project Manager will be accountable for the overall implementation of the project. The QA Manager will review all corrective actions required during the project and monitor their effectiveness in meeting project quality objectives. The corrective action process will include identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-limit QC performance that affect data quality. Corrective actions may be required during field activities, data validation and assessment. All corrective action proposed and implemented will be documented in the QA reports to the Project Manager.

Field Corrective Action

Corrective action resulting from field audits or on-the-fly adjustments will be implemented immediately if data may be adversely affected due to unexpected conditions.

Corrective action will be documented in QA reports to project management (Section C2). Corrective actions will be implemented and documented as follows:

- A description of the circumstances that initiated the corrective action
- The action taken in response

- The final resolution
- Any necessary approvals
- Effectiveness of corrective action

Laboratory Corrective Action

This project does not include analytical laboratories.

Corrective Action during Data Validation and Data Assessment

The need for corrective action may be identified during either data validation or data assessment.

QAPP Updates

The QAPP will be updated and approved by EPA as necessary.

C2 Reports to Management

The Project Manager will prepare a final report that will be shared with the QAPP distribution list. The final report will include tables and graphs developed for initial data distribution efforts and will describe the program goals, methods, quality control (QC) measures, main results, and interpretation, and include:

- Raw and drift-corrected data
- QC data and QC review
- Questionable data flagged
- Preliminary or final report

Section D. Data Validation and Usability

D1 Data Review, Verification and Validation

The goal of the data review process is to ensure that data validation and verification is conducted in an objective and consistent manner.

Field Data

Field data will be reviewed regularly by the Project Manager to ensure that the records are complete, accurate, and legible, and to verify that field activities were conducted in accordance with the protocols specified in the QAPP (refer to Section D2 for the specific elements reviewed).

Laboratory Data

This project does not include analytical laboratory data.

Data Management

The review process will include verification of QC checks run in the various data processing software applications. Detailed descriptions of these processes are included in Section D2.

D2 Verification and Validation Methods

Data verification methods will ensure that the reported results reflect what was actually done and document that the data fulfill applicable requirements. Validation will identify and evaluate the impact of any technical non-compliance or quality control non-conformance on the complete data set.

Field Data

Field records will be reviewed by the Project Manager to ensure that:

- Field notebooks and data sheets have been filled out completely, and the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good recordkeeping practices, i.e., entries are dated, data are not obliterated, changes are initialed, dated, and explained.
- Equipment maintenance and field checks were conducted in accordance with the protocols described in this QAPP, and any deviations were documented and approved.
- DQIs are calculated as described in Section D3 and results compared with Acceptance Criteria/Performance Goals (detailed in Section A7) for review by the QA and/ or Project Manager; data compare well to historic data or its "reasonableness."

Laboratory Data

This project does not include analytical laboratory data.

Data Management

Data review will include plots, logical checks, and range checks to identify suspect values. All data found not to meet QC measures will either be censored or marked as "Qualified" in the final dataset. Censored data is data that is invalid or inaccurate. Qualified data is data that is accurate even though the quality control checks were not all met. Routine system back-ups of the quality-controlled data files will be performed regularly. A detailed description of the data management and review process is provided in Section B10.

Project Deliverables

Upon completion of the verification/validation process, the resulting dataset will be uploaded to the MyRWA website for public use. The data will be in the format described in Section A9. A Quality Assurance Statement including a checklist of QA actions as well as notes on deviations and corrective actions will also be posted on the MyRWA website.

D3 Reconciliation with User Requirements

This section describes how the verified/validated project data will reconcile with the project DQOs, how data quality issues will be addressed, and how limitations on the use of the data will be reported and handled. To meet the DQOs, a combination of qualitative evaluations and statistical procedures will be used to check the quality of the data.

The data generated must meet the project DQOs defined in Section A7 of this QAPP. The primary objectives for assessing the usability of the data are to ensure that (1) data are representative conditions in the area being studied, (2) all datasets are complete and defensible, and (3) data are of the quality needed to meet the overall objectives of the project.

D3.1 Comparison to Measurement Criteria

Accuracy and Precision Assessment

The accuracy and precision of the data generated during this project will be assessed by comparison to the DQIs specified in Table A7.1. Relative Percent Difference (RPD) between repeated measurements will represent precision, and is defined by the following equation:

$$RPD = \frac{|X_1 - X_2|}{(X_1 + X_2)/2} * 100$$

where
RPD = Relative Percent Difference (%)
$|X_1 - X_2|$ = Absolute value of $X_1 – X_2$
X_1 = Original measurement
X_2 = Duplicate measurement

Data that fail to meet the data quality objectives may necessitate data reprocessing, collection of additional data, or flagging of the data, depending on the magnitude of the nonconformance, logistical constraints, schedule, and cost.

Representativeness Assessment

Representativeness of the field data will be assessed by verifying that the monitoring program was implemented as proposed and that proper techniques were used.

Completeness Assessment

Completeness is the ratio of the number of valid measurements to the total number of measurements planned for collection. See Section A7 for the completeness goal for this project. The Project Manager will assess the completeness of the overall data generation against the project goals. Following completion of the sampling, analysis, and data review, the percent completeness will be calculated and compared to the project objectives stated in Section A7 using the following equation:

$$\%C = \frac{N}{T} * 100$$

where
%C = Completeness (as %)
N = Number of usable results
T = Targeted number of samples planned to be collected

If the goal is not met, data gaps will require evaluation to determine the effect on the intended use of the data. Data re-analysis and/or collection of additional data may be appropriate depending on criticalness of the missing data, logistical constraints, cost, and schedule.

D3.2 Overall Assessment of Environmental Data

Data assessment will involve an evaluation to determine if the data collected are of the appropriate quality, quantity, and representativeness for the purposes required by project. This evaluation will be performed by the Program Manager in concert with other users of the data. Data generated in association with QC results that meet these objectives will be considered usable. Data that do not meet the objectives and/or the data validation criteria might still be usable. This assessment may require various statistical procedures to establish outliers, correlations between data sets, adequacy of monitoring coverage, evaluation of drift adjustments, etc., to assess the effect of qualification or rejection of data. The effect of the qualification of data or loss of data deemed unacceptable for use, for whatever reason, will be discussed by the Program Manager and QA Manager and decisions made on corrective action for potential data gaps.

ATTACHMENT A: Community Survey (draft)

CLEANAIR Survey Draft

1. What does air quality mean to you? [text box: short answer]

2. What do you think contributes to air quality? [text box: short answer]

3. Do you think air quality is an issue in your community? [select one]
    - Yes
    - No
    - Somewhat
    - Unsure

4. Has air quality ever affected your daily life? [select one]
    - Yes
        - If yes, please explain: [text box: short answer]
    - No
    - Unsure

5. Has your health ever been impacted by air quality?
    - Yes
        - If yes, please describe [short answer]
    - Somewhat
        - If somewhat, please describe [short answer]
    - No
    - Unsure

6. How do you know that air quality is healthy?
    - Odor
    - Appearance
    - Health issues
    - Other, please describe: [text box: short answer]

7. How do you know that air quality is unhealthy? [select all that apply]
    - Odor
    - Appearance
    - Health issues
    - Other, please describe: [text box: short answer]

8. How important of an issue is air quality in your community [select one]
    - Very important
    - Somewhat important

- Neutral
- Not important

Please respond to the following statements by selecting the

9. "I believe air quality impacts health." [select one]
   - Yes
   - No
   - Somewhat
   - I don't know
   - Please explain your answer: [short answer]

10. "Air quality impacts health in my community" [select one]
    - Strongly agree
    - Somewhat agree
    - Neutral
    - Somewhat disagree
    - Disagree

11. Where should air be tested for air pollution in your community?

    - [They have a Write in option or Google map where they can drop a pin]

12. Why did you choose this location? [Choose all that apply]
    - Visible smoke
    - Sulphur (rotten egg smell)
    - Other bad smell
    - Health concerns
    - Families/Children Living Nearby
    - Other, please describe

13. How often do you visit or pass by this location? [select one]
    - More than once a day
    - Once a day
    - About once a week
    - About once a month
    - Just once
    - Other, please explain

14. How often do you notice the problem? [select one]

- More than once a day
- Once a day
- About once a week
- About once a month
- Just once
- Other, please explain

15. When do you, or did you, notice the problem? [Choose all that apply]
    - All the time
    - Morning
    - Midday
    - Afternoon
    - Evening
    - Night
    - Other, please explain

16. Is the problem happening right now? [select one]
    - Yes
    - No
    - Unsure

17. Is it possible to reach the location by car? [select one]
    - Yes and you can park nearby
    - Yes but there is no parking
    - No
    - Unsure

18. If you know of any pollution sources near the area, please check them below. [select all that apply]
    - Power plant
    - Factory
    - Construction
    - Heavy Traffic
    - Truck idling
    - Other, please explain

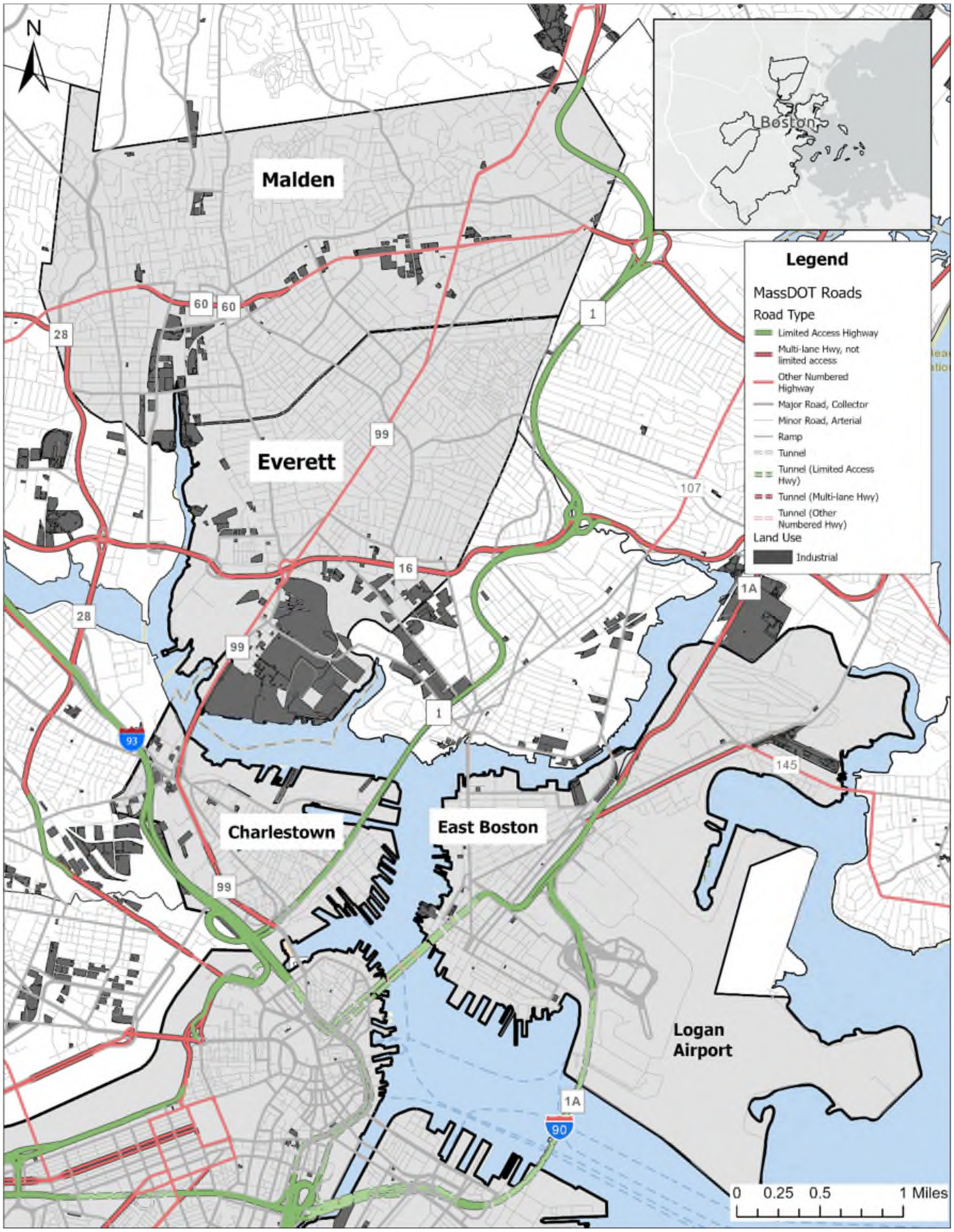
19. Are any of the following within 3 blocks of the location? [select all that apply]
    - Homes

- Schools
- Churches
- Community Centers
- Daycares
- Other, please explain

20. Do you live within 3 blocks of the location? [Optional]
    - Yes
    - No

21. Would you like to upload a picture or video of the pollution? [optional]
    - Yes
        - [If yes, upload option]

ATTACHMENT B: Map of the Lower Mystic Watershed



Monitoring sites in Malden, Everett, Charlestown, and East Boston will be chosen with input from the Community Advisory Board.

ATTACHMENT C: Field Data Sheets

Field data sheet for Dylos DC1700-PM PM2.5 and PM10 monitor.

Site name:								
Dylos#								
Dylos S/N					yes/no			
Date of last calibration:							Restart	
				Time		Data	data	
Date	visitor	PM2.5 conc.	PM10 conc.	lag(-)/gain (+)	reset	download	collection	Notes

Field data sheet for TSI 3783 condensation particle counter.

Site:												version 2
CPC#:												
CPC S/N												
Date of last calibration:						**yes/no**						
											Restart	
		Pulse	**Nozzle**		**Time**		**Fill**	**Empty**	**D-load**	**Chnge**	**data**	
Date	**visitor**	**hght (mv)**	**P (%)**	**#/cc**	**lag(-)/gain(+)**	**reset**	**water**	**water**	**data**	**wick**	**coll.**	**Notes**
4/3/2023	JD	2652	101	3.00E+04	-37 s	Y	Y	Y	Y	N	Y	CPC is working well, no problems

Calibration log and calibration checks

Dylos DC1700-PM

Pre-deployment

Date:________________ Initials:_______________

Serial number	Date of Calibration	Calibration certification (yes/no)[1]	Date of side-by-side test	Notes

[1]Certificate of calibration sent by Dylos (Yes or No)

Post-deployment (after factory re-calibration)

Date:________________ Initials:_______________

Serial number	Date of re-calibration	Re-calibration certification (yes/no)[1]	Date of side-by-side test	Notes

[1]Certificate of re-calibration sent by Dylos (Yes or No). Dylos will also send information on whether the instruments drifted from their original calibration and by how much.

Calibration log and calibration checks

TSI Model 3783 Condensation Particle Counter

Pre-deployment

Date:________________ Initials:________________

Serial number	Date of Calibration	Calibration certification (yes/no)[1]	Date of side-by-side test	Notes

[1]Certificate of calibration sent by TSI (Yes or No)

Post-deployment (after factory re-calibration)

Date:________________ Initials:________________

Serial number	Date of re-calibration	Re-calibration certification (yes/no)[1]	Date of side-by-side test	Notes

[1]Certificate of re-calibration sent by TSI (Yes or No). TSI will also send information on whether the instruments drifted from their original calibration and by how much.

ATTACHMENT D: Field Operations SOP

We will use the following SOPs in support of the field operations.

1. Dylos SOP: DYLOS DC110 | Science Inventory | US EPA

2. TSI 3783 SOP

CPC Steps:

1. Press "Stop"
2. Check "Status" and record #s on datasheet (Attachment B)
3. Remove flash drive, transfer data to folder on field laptop, and return flash drive to CPC
4. Press "Setup", reset time to match time.gov, and record time lag or gain on datasheet
5. Refill fill-bottle with distilled water and empty drain-bottle
6. Every 3rd week replace the wick
    1. Turn off vacuum and CPC
    2. Unscrew two front screws and use Allen wrench to lower wick holder assembly;
    3. Manually unscrew the wick holder from its base, separate the pieces and take out the old wick;
    4. Gently remove all buildup in wick holders: scrape with a Q-tip and blow with pressurized air as necessary;
    5. Put in new wick and reattach the wick holder to its base;
    6. Dip wick holder with new wick in fill bottle to saturate the wick and put the wick holder assembly back into the CPC;
    7. Turn in the CPC and the vacuum.
7. Press "Start" once the CPC is warmed up again.

CPC Notes:

- Model 3783 Environmental Particle Counter Operation and Service Manual
- Other errors:
    - low pulse height, nozzle pressure: check manual. Will need to open the CPC and clean the nozzle with pressurized air.
- Be sure to only use distilled water
- Normal Separator Temperature is 7 C
- Low Pulse Height (<1500) → try changing wick.