Quality Assurance Project Plan
Ambient Particulate Matter 2.5 Monitoring

Coeur d'Alene Tribe
Environmental Programs Office
Air Quality Program
2024

Prepared for:
United States Environmental Protection Agency
1200 6th Ave.
Seattle, WA 98101

Submitted by:
Brittney Nomee
Air Quality Specialist

A1. Title and Approval Sheet

Title: Quality Assurance Project Plan for the Coeur d'Alene Tribe Air Quality Program

The attached Quality Assurance Project Plan for the Coeur d'Alene Tribe Air Quality Program is hereby recommended for approval and commits the Coeur d'Alene Tribe, Natural Resource Department to follow the elements described within.

Coeur d'Alene Tribe

1) Signature: Cajetan Matheson Digitally signed by Cajetan Matheson Date: 2025.02.18 16:56:19 -08'00' Date:_____
Caj Matheson, Director
Natural Resources Department

2) Signature: Laura A. Laumatia Digitally signed by Laura A. Laumatia Date: 2025.02.18 14:41:55 -08'00' Date:_____
Laura Laumatia, Manager
Environmental Programs Office

3) Signature: Brittney Nomee Digitally signed by Brittney Nomee Date: 2025.02.20 09:05:37 -08'00' Date:_____
Brittney Nomee, Air Quality Specialist

United States Environmental Protection Agency, Region 10

1) Signature: HWAN LEE Digitally signed by HWAN LEE Date: 2025.02.24 13:17:28 -08'00' Date:_____
Cindy Fields, Quality Assurance Manager

2) Signature: INDIA YOUNG Digitally signed by INDIA YOUNG Date: 2025.02.20 10:25:56 -08'00' Date:_____
India Young, Project Officer

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A3. Distribution List

The final version and all subsequent revisions of the Quality Assurance Project Plan for Ambient Particulate Matter 2.5 Monitoring on the Coeur d'Alene Reservation will reside in the offices of the Environmental Programs Office (EPO). The air quality specialist will distribute copies to anyone who requests a copy, including the following people. Copies may be in either an electronic or printed format.

Table A3.1: Distribution List

Name	Title	Organization	Email
Caj Matheson	Director	Department of Natural Resources; Coeur d'Alene Tribe	caj.matheson@cdatribe-nsn.gov
Laura Laumatia	Manager	Environmental Programs Office; Coeur d'Alene Tribe	laura.laumatia@cdatribe-nsn.gov
Brittney Nomee	Air Quality Specialist	Environmental Programs Office; Coeur d'Alene Tribe	brittney.nomee@cdatribe-nsn.gov
India Young	Project Officer	EPA Region 10	Young.india@epa.gov
Cindy Fields	Quality Assurance Officer	EPA Region 10	Fields.cindy@epa.gov

A4. Problem Definition/Background

The Coeur d'Alene Tribe (Tribe) Air Quality Program (AQP) is responsible for operating this air quality network. The AQP incorporates quality assurance activities as an integral part of this project and is responsible for the quality and recovery rates of the data generated, data manipulation and reporting, and maintenance of the data and systems. Air Quality Specialist performs most of the associated ongoing activities, with assistance from third-party contractors. The specific responsibilities and tasks of each organization are shown below. EPA Region 10 staff will review, provide technical assistance, and approve the QAPP for implementation. They will also provide updates on new policies, review monitoring reports, and provide assistance when needed.

Data for this network are submitted to the U.S. Environmental Protection Agency (US EPA) on a periodic basis. According to a Memorandum of Agreement between the Tribe, the US EPA, and the Idaho Department of Environmental Quality (IDEQ), data are also shared with IDEQ as part of the coordinated management effort of the Idaho Montana Airshed Group.

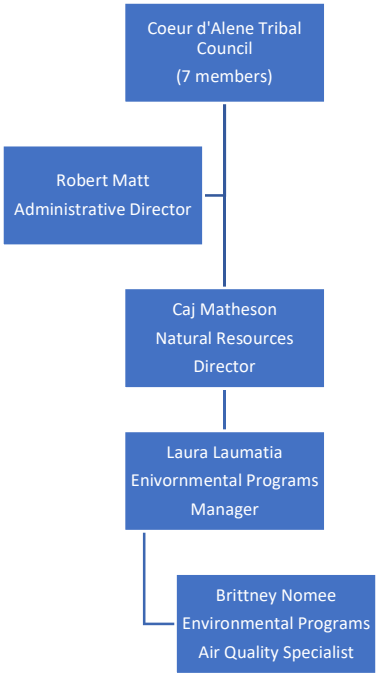
Coeur d'Alene Tribe, Natural Resources Department (DNR)

The following personnel are involved with this project. Their title and primary responsibility for the project are listed below. In the organizational chart in Figure 1, personnel at each level report to the personnel at the level above.

- Natural Resources Department Director, Caj Matheson: Directs the Department of Natural Resources, and oversees the EPO.
- EPO Manager, Laura Laumatia: Manages the EPO, which oversees the AQP. Projects QA Manager approves of monitoring data.

- EPO Air Quality Specialist, Brittney Nomee: Responsible for project oversight and coordination, internal approval and submission of QAPP, QAPP review, and distribution, responsible for ongoing data collection and reduction, generation of reports, quality assurance (QA/QC) activities, maintenance of the data and systems, oversight of contractor activities, and submission of monitoring data.

Figure A4.1: Organizational Chart



Contractors and Vendors

The private contractors and vendors that provide specialized services associated with the project include the following:

Idaho Bureau of Laboratories, Boise, ID 83720

- Quarterly independent performance systems audits of PM2.5 equipment
- Bi-annual independent performance systems audits of Meteorological Stations

Agilaire LLC, Knoxville, TN 37918

- Database and data acquisition software

Met One Instruments, Grants Pass, OR 97526

- PM2.5 monitor and meteorological equipment

A5. Problem Definition/Background

The Coeur d'Alene Tribe's (Tribe) Air Quality Program is dedicated to Protecting, Preserving, and Enhancing the Culture and Environmental Resources of the Tribe's Lands and Air Shed. The Coeur d'Alene Tribe has sovereign authority on a reservation covering 345,000 acres of mountains, lakes, timber, and farmland, spanning the western edge of the northern Rocky

Mountains and the abundant Palouse country located in the panhandle of northern Idaho. Kootenai and Benewah Counties are located within the exterior boundaries of the tribal reservation and there are four main populated areas (Plummer, Worley, DeSmet, and St. Maries).

The Tribe has a government based on executive, legislative, and judicial branches. The tribal council has seven members and operates on a parliamentary system, with members elected by Tribal vote and the Chairman elected by the Council members.

There are a few unique local air quality concerns. One, which affects all areas but is seasonal, is the practice of agricultural burning and forestry-prescribed (or slash) burning. Another is the emission from a co-generation plant located in Plummer and a lumber mill located in St. Maries. Some minor concerns are consumer-related, such as open burning and woodstove usage along with minor sources currently under FARR registration.

The Coeur d'Alene Tribal Air Quality program conducted air sampling for PM2.5 since 1996 starting under a CAA103 grant from EPA until 2007, then under EPA protocol advanced to a 105-status grant that we have been operating under to date.

The Clean Air Act (CAA) and its amendments provide the framework for protecting air quality. It requires EPA to set national air quality standards for certain pollutants and it requires EPA to develop programs to address specific air quality problems. The CAA also establishes EPA's enforcement authority and provides for air quality research. The graph below labeled as Graph A5.1, displays patients who had at least one visit to Marimn Health for the specified climate-related illnesses in each year from 2015 to 2023. Marimn Health is a nationally-recognized Tribal community health and wellness center, owned and operated by the Coeur d'Alene Tribe and located on the Coeur d'Alene Indian Reservation in Plummer, Idaho. As is evidenced in the graph, the Tribe is experiencing an uptick in incidences of heat and air-quality-related diseases that will require increased public awareness and mitigation in cooperation with Air Quality partners.

National air quality standards ensure all Americans have the same basic health and environmental protections. The EPA established National Ambient Air Quality Standards (NAAQS) for six common air pollutants. These pollutants are carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), lead (Pb), particulate matter (PM), and ozone (O3). They are also referred to as criteria pollutants. Criteria pollutants can injure health, harm the environment, and cause property damage. Most pollutants regulated by the NAAQS have two limits, the primary standard and the secondary standard. Diverse factors can affect air quality on reservations and sources of air pollutants can vary. Some examples of sources are industrial boilers, transportation sources, fugitive dust, and burning including agricultural and forestry.

The concentration of various air pollutants can be measured using monitors. Monitoring data collected can provide information on the ambient pollution levels for a given area. This information can be used to identify changes in air quality and to determine whether the area meets the NAAQS for the criteria pollutants. Air quality data are also important for determining air quality goals and the actions necessary to obtain or sustain good quality air. Proper data

collection operations must be established and operated in a manner that assures that the most applicable and highest quality data are collected.

An air quality goal of the Coeur d'Alene Tribe is to maintain an air quality monitoring network. The Tribe's ambient air quality monitoring network is located in an area where elevated pollutant concentrations are suspected, or known. Meteorological stations are often part of air quality monitoring networks, and which the case with the Tribe's network. In 2003, the Coeur d'Alene Tribal Air Quality Program constructed a Campbell Scientific Model UT30 10-meter meteorological station for collecting weather data. The program strives to protect and sustain air quality and to use any information acquired by the monitoring site to locate and address any air pollution sources that contribute to poor air quality on the reservation. This site is used to provide information about air quality impacts to the Tribal Smoke Management Program, Fire/Fuels Management Program, and the public during the burning season.

The Tribe and the State of Idaho Department of Environmental Quality (IDEQ) each desire to cooperate with the monitoring of ambient air for criteria pollutants such as particulate matter (PM2.5) and other air quality parameters in the portions of Kootenai and Benewah Counties that are within the exterior boundaries of the reservation. The Tribe and IDEQ have continued their Memorandum of Agreement (MOA) on air quality monitoring. Currently, the Tribal Air Quality Program is providing real-time particulate matter (PM2.5) data from its monitoring site located in Plummer to IDEQ for posting on their website this allows the public access to easily-retrievable data information.

The Coeur d'Alene Tribal Air Quality Program has operated under an EPA-approved Quality Assurance Project Plan (QAPP) since January 28, 2004. The QAPP will be updated for the BAM 1022, serves as a reference document for implementing the QA program, and provides detailed operational procedures for measurement processes used by the Tribe. Acceptable quality assurance procedures are necessary to provide data that meets the basic objectives and minimizes data loss. Data obtained is submitted to the EPA's Aerometric Information Retrieval System-Air Quality System (AIRS-AQS).

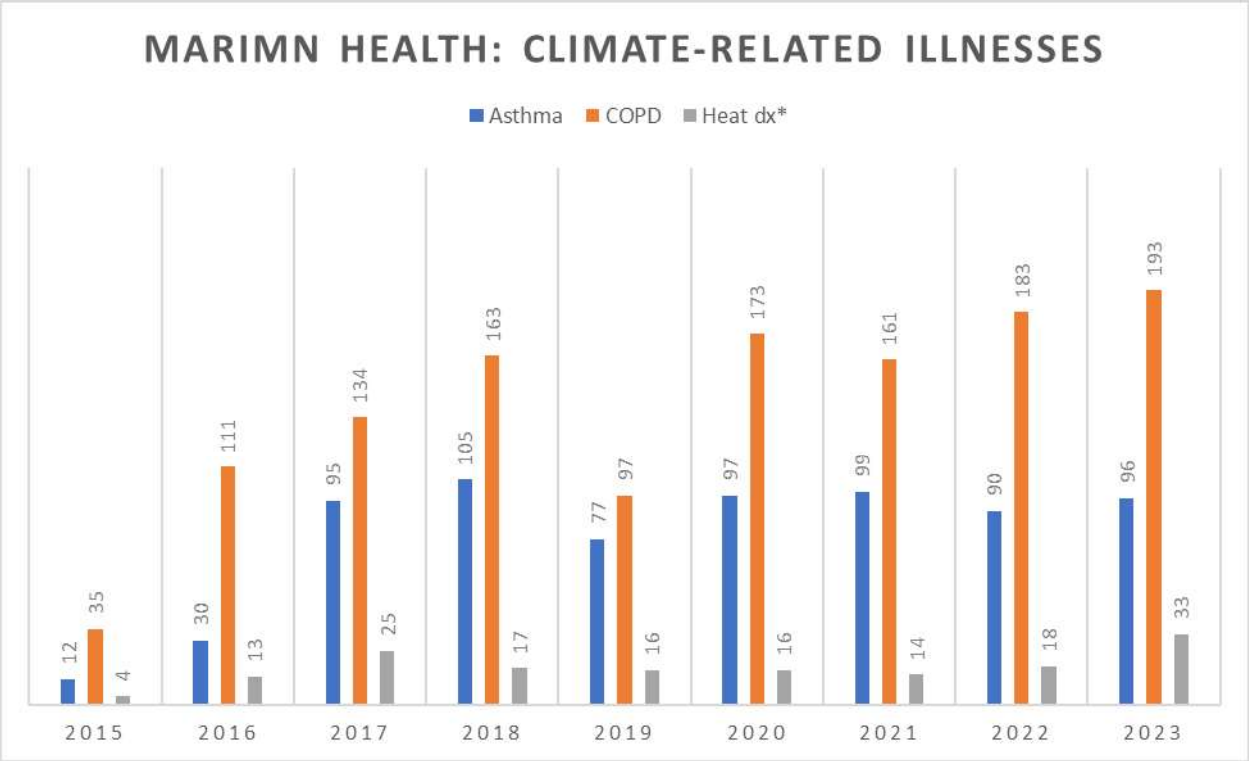
The CAA authorizes EPA "to treat Indian Tribes in the same manner as states" and accordingly, the EPA issued the Tribal Authority Rule (TAR). The TAR outlines the eligibility criteria Tribes must meet in order to be treated in the same manner as a state and defines the process by which EPA will approve tribal CAA programs. The Coeur d'Alene Tribal Air Quality Program met the eligibility criteria and was awarded TAS status by EPA on February 27, 2007.

The Coeur d'Alene Tribe has been granted Partial Delegation of Administrative Authority with EPA. This will allow EPA to delegate authority to the Tribe to administer one or more of the FARR rules on the reservation under a Federal Implementation Plan (FIP). This will not delegate any enforcement authority to the Tribe, as that will remain with EPA. This process will provide the Tribe with experience assisting EPA in implementing air quality regulations. And also provide valuable insight to the process and potential of developing its own regulatory program.

The Coeur d'Alene Tribal Air Quality program adopted three rules through the Delegation process, the first being Section 49.124 Rule for Limiting Visible Emissions. The second is Section 49.131 the General Rules for Open Burning and the third is Section 49.137 which is Rule for Air Pollution Episodes. The purpose of the FIP is to ensure that the NAAQS are attained and maintained. The FIP will allow the Tribe to play a more active role in managing tribal air resources and protecting the community's health. The FIP will enable the Tribe to monitor emissions sources within the exterior boundaries of the reservation. With the FIP development process, the Coeur d'Alene Tribe will have determined which elements best address its air quality needs which it has the best capability to administer, and the best regulatory approach.

The Coeur d'Alene Tribe is not collecting regulatory monitoring data and this is a Category 2 Project per EPA's QA Handbook.

Graph A5.1: Climate-Related Illnesses

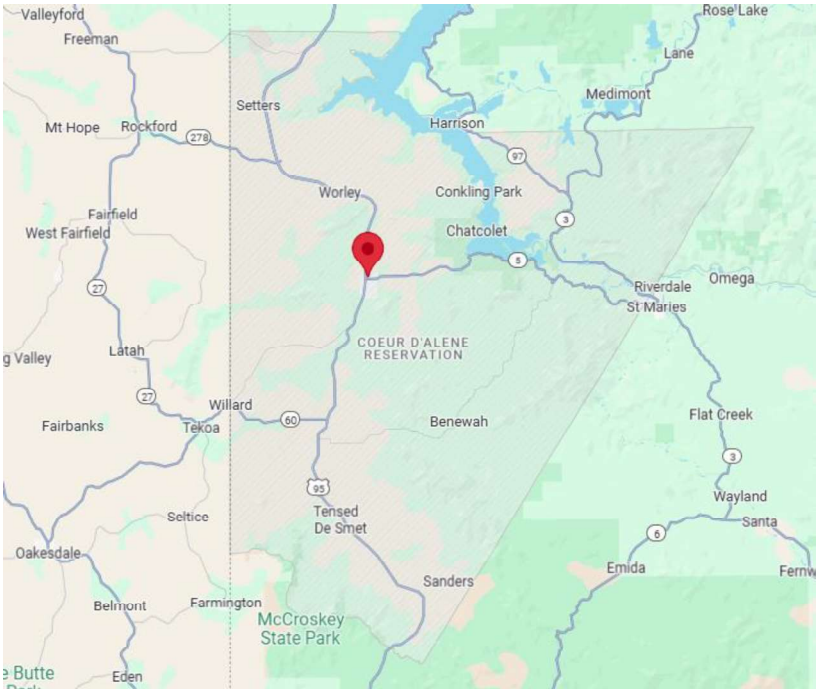


A6. Project/Task Description

The measurement goal of this project is to quantify the concentration, in units of micrograms per cubic meter (µg/m3), of particulate matter with a mean aerodynamic effective diameter less than 2.5 microns in the ambient air characteristic of the air breathed on tribal land. The method is an automated system that performs measurements 24 hours a day. QC checks will be made at least monthly. Measurements will be obtained for 24-hour daily averages, composed of hourly measurements. BAM 1022s will operate year-round.

The map in Figure 2 outlines the reservation and depicts the location of the PM2.5 and meteorological monitoring stations.

Figure A6.1: Map of Coeur d'Alene Particulate Matter 2.5 Site.



A7. Quality Objectives and Criteria

There has been concern that air quality conditions deteriorate when wildfires, industrial emissions or anthropogenic burning occurs. This office has received complaints about smoke and industrial emissions, and there are many cases of asthma in the population.

The purpose of this air monitoring effort is to provide air pollution data to the general public and Environmental Program staff in a timely manner, provide information to inform burn permit decision, and to serve as baseline data so that changes in air quality can be tracked. If air quality deteriorates, we can take appropriate action (e.g. issue burn bans, alert the public, coordinate with other agencies).

Under the Federal Air Rules for Reservations, if PM2.5 monitors are approaching 75% of the NAAQS (26 ug/m3 for 24 hour), the AQP will cease to allow permitted burning. Burn bans and public alerts may be issued.

The inputs to the decision are the data that are gathered. Data from Tribal and IDEQ monitors in the Idaho Panhandle Airshed, information on EPA AirNow Fire & Smoke map, and weather forecasts are also used in decision making. The data that will be gathered will be in accordance with all EPA recommendations and industry practice in terms of schedule, siting, etc.

The design has been optimized to fit the budget and the needs of the Tribe. Priority has been placed on the objectives presented. If the situation changes and we change our plan, then the QAPP will be revised and reissued for review and approval.

This QAPP is specific to the ambient air quality monitoring program and represents the QA program for air pollution measurement systems. The specific written procedures or methodologies for operating air monitoring equipment contained in this QAPP must be adhered to by all individuals who operate or audit the equipment in this network.

This section provides a description of the data quality objectives (DQO) for the ambient air quality monitoring program. Data quality objectives are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed, and specify the tolerable limits on the probability of making a decision error due to uncertainty in the data.

Once the DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. Measurement quality objectives (MQOs) are the translation of the DQOs into parameters that are directly measurable. The MQOs are set so that if they are met, the data user can assume that the DQOs have been met. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process. The MQOs for the Coeur d'Alene Tribe's Ambient Air Quality Monitoring Program will be defined in terms of the Data Quality Indicators (DQIs), listed below.

Precision: "Precision is a measure of agreement between replicate measurements of the same property, under prescribed similar conditions. This agreement is calculated as wither the range or as the standard deviation." (US EPA QA/G-5, Appendix D) This is the random component of error.

Bias*:* "Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction." (US EPA QA/G-5, Appendix D) Bias is determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

Comparability: "Comparability is the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent regarding measuring a specific variable or groups of variables." (US EPA/G-5, Appendix D)

Representativeness: "Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point or for a process condition or environmental condition. Representativeness is a qualitative term that should be evaluated to determine whether in situ or other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomenon measured or studied." (US EPA QA/G-5, Appendix D)

Completeness: Completeness is a metric quantifying the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Completeness can be expressed as a ratio or a percentage. Data completeness requirements are included in the reference methods (40 CFR Part 50).

For each of these attributes, acceptance criteria have been developed using various parts of 40 CFR and EPA-supplied guidance documents. The MQOs for the Coeur d'Alene Tribe's Ambient Air Quality Monitoring Program are listed in **Table 6.1**.

Table A7.1: Measure Quality Objectives for $PM_{2.5}$ and meteorological parameters.

Table A7.1 Measurement Quality Objectives – PM2.5 and Meteorological parameters		
Parameter	Criteria	Frequency
Continuous Method for $PM_{2.5}$ (BAM)		
Completeness	75% per instrument, per quarter	Quarterly
Verification, flow	± 4%	Monthly
Verification, temperature	± 2.0°C	Monthly
Verification, barometric pressure	Parameter	Monthly
Verification, leak check	≤ 1.5 lpm	Monthly
Accuracy, flow	± 4%	Quarterly
Accuracy, temperature	± 2.0°C	Quarterly
Accuracy, barometric pressure	± 10mm Hg	Quarterly
Accuracy, leak check	≤ 1.5 lpm	Quarterly
Surface Meteorological Parameters		
Completeness	90% data recovery per quarter	Quarterly
Accuracy, temperature	± 2.0°C	6 months
Accuracy, wind speed	0.25 m/s under 5 m/s, 5% over 5 m/s	6 months
Accuracy, wind direction	5°	6 months
Accuracy, barometric pressure	0.1 Hg	6 months
Accuracy, relative humidity	±5%, when 5%<RH<95%	6 months
Accuracy, precipitation	10%	6 months

A8. Special Training/Certifications

Adequate experience and training are integral to any monitoring program to assure reliable, comparable data. AQP staff assigned to this ambient air monitoring network will meet the combination of educational, work experience, responsibility, and training requirements for their positions. Records on personnel qualifications will be maintained by the Tribal Human Resources Department. Training records will be kept by staff. Both will be accessible for review during outside audit activities.

Workshops and courses hosted by Northern Arizona University's Institute for Tribal Environmental Professionals (ITEP), EPA's Air Pollution Training Institute and other similar resource agencies will be made available to project personnel. Training is aimed at increasing the effectiveness of employees and the AQP. Sufficient time (at least 16 hours) will be provided by management to the personnel directly involved in this project (including field technicians) to read and understand this QAPP and the referenced documents.

A9. Documentation and Records

Management understands that properly documenting the project's activities takes time. The AQP air monitoring network is being maintained for non-regulatory and guidance purposes. The AQP is committed to fully document all activities relating to data collection, analysis, validation, and reporting. The custody documentation requirements outlined below will ensure that the disposition and location of the data records are known, and that the data are legally defensible. Files are organized in a way that allows each data point to be tracked from the point of the beginning of the measurement through validation, analysis, and reporting. These include those records listed in tables 3, 4 and 5. The AQ Specialist will electronically distribute the most current copy of the approved QAPP to anyone who requests a copy and to the people in the Distribution List in section A3.

Table A9.1: Documentation and Records for Planning.

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Administration (establishing air program): Structuring department	Draft and final copies of grant and/or department mission statement. Maintain structure as defined (org. chart of department)		EPO Manager	When program is established, whenever organization changes or program/grant is renewed or modified
Budgeting	Budget	Funds and expenditures records (may be a subcategory under grant records)	EPO Manager	Monthly
Staffing	Hiring and personnel records	Human Resources Department (HR) and personnel file	HR Manager, EPO Manager	Within one month after any personnel changes
Training	Training records	Personnel file	AQ Specialist	Update at least annually and as training is completed
Contracting	Copies of Contracts	Support contracts	EPO Manager	When contacts are established, renewed, or changed

Objectives for the measurements planned. Quality objectives (MQOs) documented (precision, bias, completeness, representativeness)	MQOs written or adapted from Quality Assurance Handbook for Air Pollution Measurement Systems: II Ambient Air Quality Monitoring, EPA 545/B-17-001	QAPP file contains the MQOs, each draft of QAPP is filed, including revisions	AQ Specialist	During planning, and revised at least annually
Data analysis	Draft SOPs	SOP file includes the current version of each SOP	AQ Specialist	SOPs are reviewed least annually to determine if revisions are needed. Unofficial "working" versions are photocopied and filed whenever significant changes are made
Determine siting locations	Site mas and photos	Network description	AQ Specialist	Annually reviewed
Decide on site IDs	IDs for sites	Site maps/photos	AQ Specialist	Photos and maps are updated as site environment changes
Instrumentation standards ordered/purchases	Calibration labs/vendors, standard vendors	3-ring binder for all standards and calibration lab results	AQ Specialist	As updated copies are replaced, all standards files both old and new are kept
Instruments ordered/purchased Abila system decided upon/purchase	Instrument specifications Abila manual filed	Instrument and Abila manuals in the EPO Manager computer	EPO Manager	As updated copies are replaced, all standard files both old and new are kept.

Field Activities	Notes about each site visit, audit, verification, and maintenance	Site logs contain (Rite in the Rain Field Notebooks)	AQ Specialist	Logs updated each time any activity at site including audits
Office Data Logs	SOPs for data downloading, transfer and analysis	3-ring binder has notes on data downloads, database entry, and AQS entry	AQ Specialist	3-ring binder is updated as data is processed

Table A9.2: Documentation and Records for Operations.

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Audits: Quarterly external or EPA Technical Systems Audit	Audit Report	Audit File	Reviewed by AQ Specialist	Within 30 days after audit report is completed
Data gathered/received: Data transfer from analyzer	Data on Tribe's secure server	Data Log	AQ Specialist	Daily scan automated AirNow file; download at least quarterly
Maintenance Monthly site visit Monthly cleaning	Check instruments, such as pump, lines, leaks, etc. as specified in QAPP and instrument manual	Site log with notes of what was checked and results of the maintenance actions	AQ Specialist	At least monthly or if need arises
Shipping/Receiving	Shipping/receiving documents	Air Quality Program File	EPO Manager	As items come in
Site QC checks QC checks in accordance with QAPP and instrument manuals	As found conditions, flow rate, temperature and pressure parameters and results of verification	Verification checklist on calendar and Site log	AQ Specialist	The results of QC checks are reviewed during/after every site visit
Calibrations	Information on calibration data sheet	Site log	AQ Specialist	Annually or as needed, shown by QC checks

Table A9.3: Documentation and Records for Data Management.

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Data review	Scan for normal values, missing or out of range codes	Problems recorded in bound data QA log	AQ Specialist	Weekly
Maintenance Check – ensure it is being conducted according to the schedule	Reasons for missing data Internal consistency and reasonableness checks Questionable data for any reason	Data verification checklist	AQ Specialist	At least monthly
Data analysis Calculations of relevant statistics	QC results: Precision Completeness Temporal changes	AirVision database resides on a server maintained by the Tribe's IT Department	AQ Specialist	Files reviewed at minimum quarterly. Archiving annually or as needed.
Reporting to EPA	As required by grant	Problems noted in quarterly report	EPO Manager	Quarterly
Reporting to AQS	As required by AQS or grant	AQS (after review by EPO Manager)	AQ Specialist	As required by grant

Data Overview

BAM 1022 data will be downloaded and a hard copy of automated data collection information will be stored for the appropriate time frame in project files.

Data Transfer Guidelines

- Frequency – download data from servers (BAM1022, and meteorological data) at least quarterly or sooner if a problem arises. Manual download of data from instruments in the field if data collection problems persist.
- Names – download files using the naming convention that the system provides, unless another system is approved of, in which case it will be posted.
- Housekeeping – the downloaded files are moved into their own named directory at the end of each quarter or more frequently.
- Intervals – Unit is programmed to provide hourly averages. Unnecessary data processing is avoided by using the average concentration over the time period of interest.
- Downloading Data – download data using the default files that the unit's communication program provides. Our policy is to never write over any data in any file in this folder.

- Set criteria for data review:
    - Data review has two major components. The first is that which is often conducted by the analyzer system which flags or marks data with specific error or formation codes. These are preset. Codes are embedded in the file downloaded from the system. The user has a list of the meaning of these codes in the instrument's manual and data management file.
    - The second component of data review includes those imposed based on additional information. The SOP for data review includes a set of criteria used to qualify data. The following sources used to aid in qualifying data:
        - Redbook data validation tables
        - Instrument manuals
        - Common sense and experience
        - QC checks that within satisfactory range and bracket the time period of the data, which are listed in the QAPP (sections 14 and 7)
        - Specific requirements, such as other data being available for that time period.

Data Review Documentation Guidelines

- Some portion of the final data (at least five percent) is conducted by hand, including collecting and checking site logs. To write the data review SOP, at least one initial data review exercise is conducted with all logs, QC sheets, hard copies of data and validation tables, audit reports, etc. assembled on a conference table. All the steps of data review and flagging are documented in an SOP, which is also edited at least once a year to reflect changes in procedures discovered to be beneficial.
- Automation of the data review process is implemented to reduce manual error and increase speed. This may be done in a variety of programs, including AirVision or Excel, however complete documentation of the software and process will be conducted so that a checklist is followed, and the steps of data review can be reproduced if questioned.
- Data validation is documented in an office data logbook. It indicates which data files were reviewed and the reason(s) for invalidation of any set of data.

B1. Sampling Process Design (Experimental Design)

This project currently measures continuous PM2.5 concentrations using one monitor. Sampling requires continuous access to the sampling sites for flow verifications, cleaning, and general maintenance. If sites become inaccessible, sampling would continue until filter tape runs out and or the power goes out. If sites become inaccessible for long durations, it may be necessary to invalidate and null data back to when site was maintained, and instruments passed any QA checks. This decision will be made by the Environmental Programs Manager.

The PM2.5 data collected is for informational purposes because our monitors are operated as non-regulatory. We have not identified any temporal or spatial variability that would influence the data. Seasonal shifts in PM2.5 emissions are expected, for example when colder temperatures increase woodstove heating, we anticipate increases in PM2.5 concentration. Likewise, the Fourth of July and New Year's Eve are holidays when fireworks are used and higher PM2.5 concentration can be reconciled with activity.

Tables B1.1-B1.3 give the details of the probe location, site location and scale of the monitoring station.

Table B1.1: Coeur d'Alene Tribe Ambient Air Quality Network BAM 1022 & Meteorological Monitoring

AQS Site ID	Site Name / County	Latitude	Longitude	Type / Scale	Sampling Frequency
0011	Plummer/Benewah	47:20:20	116:53:05	Tribal/Neighborhood	Continuous Year-Round

Table B1.2: Particulate Matter 2.5 Citing Criteria.

Parameter	Criteria*	Plummer
Vertical placement	Inlet 2 to 7 meters above ground	3 to 4 meters above ground
Inlet exposure	Unrestricted air flow 270° around inlet	360° unrestricted flow
Spacing from obstructions	Distance between inlet and obstruction at least 2 meters	> 2 meters from obstructions
Spacing from trees	Inlet at least 20 meters from drip line	> 20 meters

Table B1.3: Equipment Identification

Site	PM2.5 Monitoring Equipment
Plummer	BAM 1022; ID=W19938

B2. Sampling Methods

The measurement goal of this project is to accurately measure and record the concentrations, in units of micrograms per cubic meter (µg/m3), of airborne particles less than or equal to 2.5 micrometers (µm) aerodynamic diameter, at actual (LTP) conditions.

The BAM1022 analyzer in this network was installed with adherence to the analyzer manufacturer's operation manual, and sited as per Table 6, with the exception of the BAM1022 which will be operated in non-FEM mode (i.e., with a sharp cut cyclone not a very sharp cut cyclone).

The Standard Operating Procedures (SOPs) for the BAM 1022 is in Appendix A of this document.

Data from BAM 1022 PM2.5 instrument is collected and stored as hourly PM concentration data. The instruments calculate, report, and record hourly PM concentrations. Data acquisition for BAM 1022 PM2.5 data and meteorological data is with Agilaire's AirVision software. The AirVision software is configured to push hourly data to AirNow. The State of Idaho polls our BAM 1022 PM2.5 data directly. Coeur d'Alene Tribe PM2.5 data is displayed on the Idaho

Department of Environmental Quality's air monitoring map and on AirNow (BAM1022) and AirNow fire and Smoke (all PM2.5 data).

The AirVision software maintains raw hourly data and flagged data. QA checking and flagging are done within AirVision software. The Airsis network is the raw data for the EBAM data. EBAM data is QA checked in an Excel spreadsheet manually.

Supplies for monitoring equipment are ordered in advance and stored in AQP lab space. Filter tape, extra pumps, and rebuild kits are in the stash. When data is missing, or equipment breaks the environmental specialist investigates. Troubleshooting is primarily their responsibility. Technical service is sought from Met One Instruments and on occasion from IDEQ field staff or other Tribal Air professionals.

Air Quality Specialist informs Environmental Programs Manager when problems arise and keep her informed of progress and needs. The annual ambient monitoring report documents data completeness by month, quarter, and year. Any problems with the network are documented in this report.

B3. Sampling Handling and Custody

The continuous data does not require laboratory or chain of custody handling procedures. In the case of these instruments that do not collect samples, sample custody is data custody. Because the data may be used for a variety of purposes, we will take extreme care and allow for adequate time in downloading data, verifying correct download, copying, and naming electronic files, transferring data, and data entry. The data will be entered into a computer database, where an electronic record will be kept. BAM 1022 data will also be entered in the EPA AQS database.

B4. Analytical Methods

The field standard operating procedures for PM2.5 instruments and meteorological sensors are Appendix A of this document. The transfer standard used to verify flow, temperature, and barometric pressure is the Streamline Pro from Chinook Engineering. It is certified annually. The tipping bucket precipitation gage is cleaned at a minimum of every six months. It is challenged during independent audit every six months. Cleaning supplies like paper towels, cotton swaps, microfiber cloths, and water are kept in a field tote bag for monthly use. Filter tape, pump rebuild kits are purchased in anticipation of use and stored in the AQP lab space until needed.
Replacement parts for failures are purchased as needed when identified by the field operator (AQ Specialist) or advised by technical services.
Records are kept in the field notebooks, and office records are maintained for a minimum of 5 years electronically. The AQ Specialist is responsible for initiating purchases and ordering. The EPO Manager is responsible for administrative paperwork for payment.

Continuous BAM Method for PM 2.5
BAM 1022 is deployed in Plummer. Although the instrument has FEM status when operated as per the user manual, we will operate our BAM 1022 to collect non-FEM data by using a different cyclone. The sampler draws ambient air through a size selective inlet at a constant flow rate.

When beta rays emitted from the radioactive decay of 14C (carbon-14) interact with nearby matter they lose their energy and, in some cases, are absorbed by the matter. The process is known as beta-ray attenuation and is the principle of operation of the BAM 1022. When matter is placed between the radioactive 14C source and a device designed to detect beta rays, such as a photomultiplier tube with a scintillator, beta rays are absorbed and/or their energy diminished. This results in a reduction in the flux of beta rays detected. The magnitude of the reduction in detected beta rays is a function of the mass of the absorbing matter between the 14C beta source and the detector.

The beta ray flux passing through absorbing matter, such as dust deposited on a filter tape, decreases nearly exponentially with the mass through which they much pass. Equation 1 shows this relationship.

Equation 1

$$M = \frac{S}{\mu} ln\left(\frac{I_0}{I}\right)$$

In Equation 1, I is the measured beta ray intensity (counts per unit time), of the attenuated beta ray (dust laden filter tape), I_0 is the measured beta ray intensity of the non-attenuated beta ray (clean filter tape), μ is the absorption cross section of the material absorbing the beta rays (cm2/g), and S is spot size (cm2).

It is a *differential* measurement: what is being measured is the change in mass that occurs during the measurement cycle. For the BAM 1022 this change in mass is mainly caused by particulate deposition onto the filter tape during the sampling process and changes in air density above and below the filter tape during the measurement process caused by fluctuations in temperature and pressure. The BAM 1022 continuously monitors the air temperature and pressure above and below the filter tape, determines the changes in these measured parameters during the measurement cycle and then compensates for them in order to accurately determine mass deposition that occurs on the filter tape during the measurement event. The filter tape mass remains constant during the measurement process and therefore is not part of the differential mass.

What makes the beta attenuation method so successful and so versatile is that the absorption cross section "μ " is, to an excellent approximation, dependent only on mass (and not on chemical composition) for species likely to be sampled during ambient monitoring.

In order to convert sampled mass $M(mg)$ into aerosol concentration (instrument output), the following scaling factor is used:

Equation 2

$$C\left(\frac{mg}{m^3}\right) = k\frac{M(mg)}{Q(m^3)} + BKGD\left(\frac{mg}{m^3}\right)$$

The "k" factor is determined experimentally *during the factory calibration process* by comparing the mass output of the BAM 1022 under test with the mass output of a transfer standard beta

gauge that has been calibrated against gravimetrically traceable standards. "*Q*" is the sampled volume during the measurement. "BKGD" is the recorded mass value of the BAM 1022 under test in the absence of any mass accumulation and is determined in the field. For the BAM 1022, the rate at which mass accumulates onto the filter tape during the measurement cycle determines the minimum usable time resolution of the device.

B5. Quality Control

To assure high quality of data from air monitoring measurements, two distinct and interrelated quality assurance functions must be performed. The first and overarching function is the control of the project through broad quality assurance objectives and activities, such as establishing policies and procedures, developing data quality objectives, assigning responsibilities, conducting regular reviews of data and procedures, training, external audits, and implementation of corrective actions when deficiencies are identified. The other is the control of specific components of the measurement processes through detailed quality control procedures and checks including audits, calibrations, replicate analyses, data review, precision and accuracy assessments, routine self-assessments, etc.

In this project, QC activities are used to ensure that measurement objectives, as detailed in Section 7, are maintained within the acceptable criteria. In the case of this project, many of the criteria are established through US EPA QA Guidance.

Calibration is the comparison of a sensor or measurement against a calibration or transfer "standard" of known accuracy, to record, and then eliminate by adjustment, any deviation in the accuracy of the measurement being compared. The purpose of calibration is to improve measurement accuracy and minimize bias.

For PM2.5, calibration activities follow a two-step process:

1. Certify the calibration/transfer standard against an authoritative, NIST-traceable standard, then
2. Compare the calibration standard against the routine sampling/analytical instruments.

Calibration requirements for the critical field and laboratory equipment are found in Table B5.1. If criteria are not met, data are typically invalidated and flagged back to last passing check.

Table B5.1: Quality Control and Accuracy Matrix.

Activity	Frequency	Acceptance Criteria	Information Provided
Continuous BAM 1022 PM2.5 Measurement Systems - Verification			
Flow Rate	Monthly	± 4% of transfer standard	re-calibrate instrument
Ambient Temperature	Monthly	± 2° C of transfer standard	re-calibrate instrument
Barometric Pressure	Monthly	± 10 mmHg of transfer standard	re-calibrate instrument

Leak Check	Monthly	≤1.5 lpm	follow operating manual to eliminate leak
Continuous BAM 1022 PM2.5 Measurement Systems - Calibration			
Calibration: ambient temperature barometric pressure, & flow rate	Initially, as needed, at least annually	same as verification	See Operating Manual
Continuous BAM 1022 PM2.5 Measurement Systems - Accuracy			
Flow Rate	Quarterly	± 4% of transfer standard	re-calibrate instrument
Ambient Temperature	Quarterly	± 2° C of transfer standard	re-calibrate instrument
Barometric Pressure	Quarterly	± 10 mmHg of transfer standard	re-calibrate instrument
Leak Check	Quarterly	≤1.5 lpm	follow operating manual to eliminate leak

Precision Checks

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. To meet the data quality objectives for precision, the Coeur d'Alene Tribe Air Quality Program must ensure the entire measurement process is within statistical control. The type of precision measurements made is the monthly flow verification.

Flow Verification and Audits

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value and includes a combination of random error and systematic error. The accuracy checks implemented in this project are flow rate verifications and audits.

The AQ Specialist will perform flow rate verification on each sampler monthly. The verification is performed by measuring the sampler flow rate using a certified flow rate transfer standard. This check follows the SOPs in Appendix A.

The procedures used to calculate measurement uncertainty are described below. These procedures must be performed by an independent organization capable and qualified to perform such audits. The equipment used must be NIST traceable and cannot be the same equipment used to perform the sampler calibration.

Accuracy of a Single Sampler - Single Check (Quarterly) Basis (e_i) The percentage error (e_i) for a single flow rate audit *i* is calculated using Equation 7, where X_i represents the audit standard flow rate (known) and Y_i represents the indicated flow rate.

$$e_i = \frac{Y_i - X_i}{X_i} \times 100$$ Equation 7

Bias of a Single Sampler - Annual Basis (D_j) For an individual particulate sampler j, the average (D_j) of the individual percentage errors (e_i) during the calendar year is calculated using Equation 8, where n_j is the number of individual percentage errors produced for sampler *j* during the calendar year.

$$D_j = \frac{\sum_{i=1}^{n_j} e_i}{n_j}$$ Equation 8

Corrective Action - The single sampler accuracy requirement is ± 4%. If an audit violates the acceptance criteria, corrective action may include: checking the sampler for internal and external leaks; ensuring that temperature and pressure are within acceptable ranges; auditing a second time; performing a multi-point calibration; and re-certifying the calibration and/or audit flow transfer standard.

Reference Standard Certifications
Reference transfer standards are used to measure and calibrate flow rate, temperature, pressure difference, and barometric pressure of the field sampling equipment. Transfer standards receive NIST traceable certifications annually. Standard Operating Procedures and specifications for transfer standard certifications are included in Appendix A.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

None of the PM2.5 analyzers used in this network are designated federal reference methods (FRM) or federal equivalent methods (FEM).

The AQ Specialist will perform single point verification checks of the equipment. If any of these checks are out of specification, the AQ Specialist will contact the vendor for initial corrective action. If the instrument meets the acceptance criteria, it will be assumed to be operating properly. These tests will be documented and filed as indicated in section A9.

Through the process of system integration and assembling components to create the measurement system, each component is initially inspected and tested by the AQ Specialist. Operation manuals of components are consulted for testing procedures and indicators of correct operation. Air sensors will be operated as per manufacturer's recommendations.

Inspections

The systems are inspected at least quarterly by the AQ Specialist. Following is a list of items checked during each inspection.

PM2.5 Instrument

- Enclosure – is it functional and clean? Clean dust with microfiber cloth and water if needed.
- Instrument status – Is there an error code? If the tape breaks or runs out, replace tape. Follow operating manual for other problems.
- Sample pump operational – is it running, how loud is it? Rebuild pump or replace if needed.
- Instrument filter usage – is there enough tape to run until next visit? Replace BAM1022 tape every 7-8 weeks or more frequently as needed during wildfire. EBAM tape needs monitoring, the tape advance rate can be set on the instrument. Replace when it will run out prior to next visit.

Meteorological instruments

- Datalogger enclosure – Check clock, clean enclosure if dirty.
- AT/RH probe – Wipe with microfiber cloth if dirty.
- Barometric pressure – Check for insects, clean, if necessary, wipe exterior of box if dirty.
- Sonic anemometer and audit cup and vane – Check and clean bird droppings and dust if necessary.
- Tower and gin pole – Inspect each time tower is lowered for audit or verification. Look at bolts and connections on the gin pole especially. Replace if wore or rusted.

Preventive Maintenance

Table B6.1 summarizes the preventive maintenance procedures for this project. In general, the manufacturer's preventive maintenance schedules and procedures are followed by the AQ Specialist.

Table B6.1: Preventive Maintenance Schedule.

Component	Item	Interval	Procedure/reference
BAM 1022 Instrument	Replace the filter tape	8 weeks or as needed	Operating manual Sec. 4.2
	Basic leak check	8 weeks	Operating manual Sec. 6.2
	Nozzle, vane and pinch roller cleaning	8 weeks	Operating manual Sec. 6.6
	Flow audit (verify and/or calibrate flow system)	8 weeks	Operating manual Sec. 6.4
	Clean PM10 inlet particle trap	Monthly or more frequent if needed	Manual
	Clean PM2.5 cyclone particle trap	Monthly or more frequent if needed	Manual

	Verify or set the clock	8 weeks	Operating manual Sec. 3.5.1
	Mass Audit	6 months	Operating manual Sec. 6.8
	Background determination	Annually	Operating manual Sec. 6.5
	Internal Nozzle Cleaning	6 months	Operating manual Sec. 6.7
	Replace the pump muffler	As needed	Operating manual Sec. 3.4.11
	Build AC Pump	As needed	BX-126 Manual
	Empty PM10 inlet water jar	As needed	n/a

Corrective Maintenance
Corrective maintenance is non-scheduled maintenance activities that become necessary due to system malfunctions. A few examples of corrective maintenance are replacing a damaged pump, replacing a blown fuse, and replacing dead batteries. The need for corrective maintenance becomes apparent as operators perform audit and calibration procedures, or from the recorded results. The instrument operation manual is referred to first for assistance in troubleshooting. The manufacturer's service technicians are consulted if necessary. AQ Specialist will record all maintenance activities in a logbook to identify and correct any recurring malfunctions.

B7. Instrument/Equipment Calibration and Frequency

Instrumentation in this project is routinely checked and calibrated as necessary. Calibration specifications are detailed in Table B1.1.

Calibrations include adjusting the instrument or sensor to produce a response that is consistent with a standard. Calibration of a flow rate, for example, must consist of at least three separate flow rate measurements (a multipoint calibration, which is different than a multipoint verification) approximately evenly spaced within the range of the operational flow rate. Table B7.1 summarizes the calibration frequency and requirements of the equipment used in this project. Calibration activities follow a two-step process:

1. Certifying the calibration standard (this may be a thermometer kept in the office except when it is used for calibrations, a flow rate transfer standard, a barometer, or whatever is appropriate to the sensor or instrument being calibrated) against a NIST standard (usually done by sending the calibration standard to a weights and measures laboratory), and
2. Comparing the calibration standard and/or transfer standard against the routine samplers or sensors.

Samplers
BAM 1022are calibrated following a periodic maintenance schedule outlined in section 6.1 of the operation manual (found in Appendix A).

Field standards requiring calibration include flow transfer standard, temperature standards, altimeters/barometers, and manometers and the calibrations are done yearly. The procedures used for these calibrations are detailed in Appendix A, Standard Operating Procedures. These calibrations are the responsibility of the AQ Specialist and are usually subcontracted.

Calibration Methods
Flow rate verifications are performed at least monthly on BAM1022. If verification is out of specification, then a software calibration is conducted. A software flow controller calibration is conducted when either verifications or audits are out of specification. The BAM have a mass audit every six months and annual background determination.

Single point ambient temperature and barometric pressure calibrations are performed annually or when verifications or audits are out of specification. Quarterly audits are performed by a third-party contractor. If any measurements are found out of specification, the sampler is then calibrated. The Standard Operating Procedures used for these calibrations are detailed in operation manuals located in Appendix A, and are the responsibility of the AQ Specialist.

Calibration Standards
The following is a discussion of the calibration standards used in the field, the specifications of which are listed in Table B7.1.

Flow Rate: The project has a flow transfer standard that is sent away for independent NIST traceable certification annually. Transfer standards have less than 1% uncertainty through the range of ambient temperatures encountered.

Temperature: Electronic thermometers are used to verify and calibration sampler temperature sensors in the field. These are certified, traceable to NIST, at least annually.

Barometric Pressure: Electronic field altimeters are used to verify and calibration sampler barometric pressure. These are certified, traceable to NIST, at least annually.

It may be necessary to recalibrate flow, temperature, or pressure sensors for other reasons, such as radical changes in equipment performance, before a complete instrument calibration, or other reasons determined by the QA Manager (EPO Manager).

Table B7.1: Calibration Requirement

Equipment used to calibrate field equipment	Acceptance Criteria	Frequency
Flow	2% of NIST traceable standard	annually
Temperature	2% of NIST traceable standard	annually
Barometric Pressure	±10 mmHg NIST traceable standard	annually

B8. Inspection/Acceptance for Supplies and Consumables

The AQ Specialist uses a variety of supplies. When these are received, they are inspected for proper part number, size, and condition. Vendors are contacted if any problem is observed. Various supplies and consumables are used in association with this project. Consumables are purchases that meet the criteria specific for the application. Each item received is visually inspected by the AQ Specialist for integrity before being placed in service.

B9. Non-Direct Measurements

This section addresses existing data not obtained by direct measurement in our ambient PM2.5 monitoring. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the project in a variety of ways. The use of information that fails to meet the necessary assurance objectives for ambient PM2.5 monitoring can lead to erroneous trend reports and decisions. The policies and procedures described in this section apply both to data acquired through the project and to information previously acquired and/or acquired from outside sources.

Chemical and Physical Properties Data

Physical and chemical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources. Other data sources may be used with the approval of the EPO Manager or AQ Specialist. The following sources may be used in this project without prior approval: NIST, ISO, IUPAC, ANSI, and other widely recognized national and international standards organizations, US EPA, and air quality, scientific, and engineering reference handbooks.

Sampler Operation and Manufacturer's Literature

Another important source of information needed for sampler operation is manufacturers' literature. Operations manuals frequently provide numerical information and equations pertaining to specific equipment and procedures.

External Data Bases

No data obtained from the Internet, computer bulletin boards, or data bases from outside organizations shall be used in creating reportable data or published reports unless documentation of the source of the data is attached to the report.

Data from the EPA AQS database may be used in published reports with appropriate caution. Care must be taken in reviewing/using any data that contain flags or data qualifiers. If data is flagged, such data shall not be utilized unless it is clear the data still meets critical QA/QC requirements. It is impossible to assure that a data base such as AQS is completely free from errors including outliers and biases, so caution is called for in comparing Coeur d'Alene Tribe data from other reporting agencies as reported in AQS. The AQ Specialist should review available QA/QC information to ensure that the external data are comparable to Coeur d'Alene Tribe measurements and that the original data generator had an acceptable QA program in place.

Speciated Particulate Data

Existing chemical speciation data for elements exist. These results may be used to estimate historical baselines after review and approval for use by the EPO Manager.

US Weather Service Data
Meteorological information is gathered from several nearby US Weather Service stations. Parameters generally include temperature, relative humidity, barometric pressure, rainfall, wind speed, wind direction, cloud type/layers, percentage cloud cover, and visibility range. No changes to how the data are collected are anticipated due to the addition of the fine particulate data to the Coeur d'Alene Tribe Ambient Air Monitoring Network.

B10. Data Management

BAM data is calculated and recorded in the instrument. As long as the instrument is operating within the acceptance, data management requires only periodic downloading and review.

Data from the BAM1022 are downloaded from Agilaire data acquisition onto a server housed in the Information Technology Department of the Coeur d'Alene Tribe. The data from the BAM 1022 is sent to the Idaho Department of Environmental Quality Real-Time. The Aqilaire system pushes our BAM 1022 data to IDEQ, then pushes the data to AirNow. The AQ Specialist has an AirNow tech account to access the data. Data from the instruments are collected no less than quarterly for processing and reporting purposes.

Data Validation
Data validation is a combination of checking that data processing operations have been carried out correctly and monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once the problems are identified, the data can be corrected or invalidated, and corrective actions can be taken for field or laboratory operations.

The data validation process is interactive and performed by the AQ Specialist. Software tools (e.g., database programs) perform a preliminary check of data to find anomalies (reasonable values, instrument status, etc.). The ultimate authority to accept or reject these determinations lies with the EPO Manager.

Data Transmittal
Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file and electronic transfer of data over a telephone or computer network. Table B10.1 summarizes data transfer operations.

Table B10.1: Data Transfer Operations.

Description of Data Transfer	Originator	Recipient	QA Measures Applied
BAM Data			
Electronic Data Transfer	Data acquisition system	AQ Specialist	Transmission protocols

Calibration & verification data	AQ Specialist	EPO Manager	Entries spot-checked by the reviewer
Audit data	Contract Organization (IBL)	AQ Specialist	Entries spot-checked by the reviewer
Meteorological Data			
Analog and pulsed data transfer	Sensor	Data acquisition system	Included in system calibration
Electronic data transfer via modem or manual download	Data acquisition system	AQ Specialist, 3-ring binder	Transmission protocols
Audit data	Contract Organization (IBL)	AQ Specialist	Entries spot-checked by the reviewer

Audit Trail
The Audit Trail is an important concept associated with data transformations and reductions. An audit trail is an administrative structure that provides documentation for calculations, transformations, certifications, and/or any changes that may be made to data. The audit trail is an administrative structure that provides documentation for calculations, transformations, certifications, and/or any changes that may be made to data. The audit trail is kept on file in paper form.

Typical reasons for changes include the following:
- corrections of data input due to human error
- addition of new or supplementary data
- flagging of data due to QA being out of specification
- flagging of data as invalid or suspect due to inspection

The project audit trail is implemented on paper or within the electronic databases with the following information:
- person making change
- date and time of change
- reason for change
- full identification of information changed
- value of the item before and after a change

Data Analysis
The Environmental Specialist or contractor will provide, at a minimum, the following calculations:
- Single site measurement accuracy
- Single site measurement precision
- Data completeness per sampler, and for the network

Data Flagging - Sample Qualifiers
A sample qualifier or a result qualifier consists of 2 alphanumeric characters which act as an indicator of the fact and reason that the data value (a) did not produce a numeric result, (b)

produced a numeric result but it is qualified in some respect relating to the type or validity of the result or (c) produced a numeric result but for administrative reasons is not to be reported outside the laboratory. Qualifiers will be used both in the field and in the laboratory to signify data that may be suspect due to contamination, special events, or failure of QC limits. The AQS website contains a complete and updated list of the data qualifier codes http://www.epa.gov/ttn/airs/airsaqs/.

Data Storage and Retrieval
Data archival policies for PM2.5 monitoring program are shown in Table B10.2

Table B10.2: Data Archive Policies.

Data Type	Medium	Location	Retention Time	Final Disposition
Audit trail	Hardcopy	CDA Tribe	Indefinite	CDA Tribe AQP Archive
Field notes & data sheets	Hardcopy	CDA Tribe	3 years	CDA Tribe AQP Archive
Raw data	Electronic	CDA Tribe	5 years	Archived on AQ Computer
BAM 1022 PM2.5 & meteorological data – QA checked	Electronic	CDA Tribe	Indefinite	Archived in AirVision database and AQS

C1. Assessments and Response Actions

An assessment, for this QAPP, is defined as an evaluation process used to measure the performance or effectiveness of the system. The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. The annual monitoring report summarized the annual assessment. It is drafted by the AQ Specialist (annually by the end of February), approved by the EPO Manager (annually by the end of March), and submitted to the EPA Project Officer (annually by the end of April).

Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and report phases is important to data users, who can then consider the impact of these control efforts on the data quality. Both qualitative and quantitative assessments of the effectiveness of these control efforts will identify those areas most likely to impact the data quality and to what extent. Annual assessments of data quality are reported to the EPA in the annual monitoring report. The selection and extent of the QA and QC activities used by a monitoring agency depend on several local factors such as the field conditions, the objectives for monitoring, the level of the data quality needed, the expertise of assigned personnel, the cost of control procedures, pollutant concentration levels, etc.

To ensure the adequate performance of the quality system, the following assessments will be performed:

- Monthly verifications by the Coeur d'Alene Tribe Air Quality Specialist
- Quarterly Audits conducted by a qualified independent auditor, as resources allow

- Annual monitoring report by the Coeur d'Alene Air Quality Specialist

Number and Types of Monitors
For PM2.5 Monitoring, the number of monitors required depends upon the measurement objectives. Section B of this QAPP discusses this project's PM2.5 Network. The adequacy of this network will be determined by using the following information: new research findings, Tribal directives, new regulations, professional judgment, special studies/saturation sampling, dispersion modeling, and revised monitoring strategies (e.g., lead strategy, reengineering air monitoring network).

Location of Monitor
The location of the monitor is guided by the AQ Specialist to meet the Tribe's monitoring objectives. Dispersion modeling, health effects data, maps, graphical overlays, and GIS-based information help visualize or assess the adequacy of monitor locations. Plots and contours of emissions and or potential emissions impacts and/or historical monitoring data versus monitor locations will also be used.

Other Review Topics
Other subjects for consideration as part of the network review and overall adequacy of the monitoring program will include installation of new monitors, relocation of existing monitors, siting criteria problems and suggested solutions, problems with data submittals and data completeness, maintenance and replacement of existing monitors and related equipment, quality assurance problems, air quality studies and special monitoring projects, and new issues, proposed regulations, and funding.

C2. Reports to Management

This section describes the quality-related reports and communications to management necessary to support the associated data acquisition, validation, assessment, and reporting.

Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Quality assessment is conducted to help ensure that measurement results meet project objectives and to ensure that necessary corrective actions are taken early when they will be most effective.

Effective communication among all personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following: adherence to scheduled delivery of data and reports, documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality, and analysis of the potential uncertainties in decisions based on the data.

Quarterly reports will provide the results of performance evaluations and system audits; results of periodic data quality assessments; and significant quality assurance problems and recommended solutions.

Air quality data submitted for each quarter reporting period will be edited, validated, and entered in the AQS. The Coeur d'Alene Tribe Air Quality Specialist will be responsible for entering the data into the AQS.

Any feedback pertaining to data, analysis or improvements will be appraised and appropriate action taken. All reports, equipment manuals and documents are on file in the AQ Specialist's Office and can be requested as needed.

D1. Data Review, Verification, and Validation

Each of the network's instruments is employed to measure the ambient PM 2.5 concentration or meteorological conditions. To be useful, the data must undergo evaluation to determine that it meets the quality objectives. Deviation from the QAPP or SOP may influence the quality of the data and or decisions made with it.

Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. That includes, for examples, checking for data entry, transcriptions, calculation, reduction, and transcription errors. All Coeur d'Alene Tribe Ambient Monitoring data is recorded electronically, and no transcription, calculation, reduction, or transformation errors are expected. Potential errors from DAS collection problems or failure to flag and or invalidate values recorded during field verifications or maintenance are possible.

Data verification is the process for evaluating the completeness and correctness of the data set against the methods and procedures. It is assumed data collected with instruments that pass QA criteria is correct. Completeness is evaluated daily, monthly, and annually. Failure to meet data completeness criteria may influences measurements differently. For example, computing an annual precipitation value without data collection during the wet season or having a PM2.5 instrument failure during wildfire smoke event.

Data validation is the sample-specific process that extends the evaluation of data beyond method and provides procedures to determine the quality of the data set relative to the end use. It focuses on the project's specifications or needs, designed to meet the needs of the decision makers/data users and should note potentially unacceptable departures from the QA Project Plan. The potential effects of the deviation can be evaluated during the data quality assessment and are discussed in the ambient monitoring report.

The major objective for this project is to protect human health and natural resources by measuring PM2.5 ambient air concentration to generate the AQI and communicating this to the public. The ambient air monitoring data also supports administrative activities under the Federal Air Rules for Reservations. Verification of proper PM2.5 sample collection is assured by the ongoing proper operation of the instrument, and regular review of data for reasonableness. Validation activities of the data collection use quality control data to validate the proper and adequate implementation of data collection. Therefore, validation of QC procedures will require a review of the documentation of the corrective actions that were taken when QC samples failed to meet the acceptance criteria, and the potential effect of the corrective actions on the validity of the routine data. Tables of scheduled work are in Appendix B.

D2. Verification and Validation Methods

The system requires review of data collected. With automated data processing system some procedures for data validation are incorporated into the basic software. Data is viewed graphically in the AirVision software by parameter or as grouped parameters to spot unusually high (or low) values (outliers) that might indicate an error in the data collection system. The computer scans data values for extreme values, outliers, or ranges. Questionable data values are then flagged to indicate a possible error or invalidated. Some data parameters are always flagged and invalidated together. For example, the air temperature and relative humidity probe generates dew point data, so if air temperature or relative humidity is invalidated, so is the corresponding dew point. The same is true for our wind speed and wind direction data measured with a sonic anemometer.

Data verification can be defined as confirmation, through provision of objective evidence that *specified requirements* have been fulfilled. Data verification process involves the inspection, analysis, and acceptance of the field data or samples. Our internal inspections, include but are not limited to the following:

- Were the environmental data operations performed according to the SOPs governing those operations?
- Did the sample or monitor perform correctly? Individual checks such leak checks, flow checks, meteorological influences, and all other assessments, audits, and performance checks must have been acceptably performed and documented. Checks also need to be completed within the prescribed time frame such as monthly, quarterly or yearly.
- Did the environmental sample pass an initial visual inspection? Many environmental samples can be flagged (qualified) during the initial visual inspection.
- Have manual calculations, manual data entry, or human adjustments to software settings been checked? Were automated calculations verified and accepted prior to use? At what frequencies were these calculations reviewed to ensure that they have not changed?

Data validation is a routine process designed to ensure that reported values meet the quality goals of that environmental data operations. Data validation is further defined as examination and provision of objective evidence that the particular requirements for a specific *intended* use are fulfilled. A progressive, systematic approach to data validation must be used to ensure and assess the quality of data.

Many of the processes for verifying and validating the measurement phases of the PM2.5 data collection operation have been discussed in Section B10. If these processes, as written in the QAPP, are followed, and the sites are representative of the conditions for which they were selected, one would expect to achieve the PM2.5 DQOs. However, exceptional field events may occur, and field activities may negatively affect the integrity of samples. In addition, it is expected that some of the QC checks will fail to meet the acceptance criteria and data may be invalidated. Problems that affect the integrity of data are identified in the form of flags. It is important to determine how these failures affect the routine data. The review of this routine data and their associated QC data will be verified and validated.

The environmental specialists are responsible for verifying and initially validating the data. The air quality coordinator is responsible for the final data validation, the ambient monitoring report submitted to EPA. Our AQS data is not validated.

End of year reports and graphics are presented to the Coeur d'Alene Tribe's Natural Resources Departments. Preliminary data is shared on AirNow, AirNow Fire and Smoke, IDEQ ambient monitoring map, Air Idaho app, and through IDEQ wildfire products. Environmental specialists are responsible for informing partners of collection errors and high values recorded during maintenance that show on preliminary data sites.

Data Verification
After a sample batch is processed, a thorough review of the data, utilizing random spot checks, will be conducted for completeness and data entry accuracy. Once the data is entered into the DAS, the system will review the data for routine data outliers and data outside of acceptance criteria (for example, PM2.5 < -10 ug/m3). These data will be flagged appropriately. All flagged data will be "reverified" that the values are entered correctly.

Data Validation
Validation of measurement data will require two stages, one at the measurement value level, and the second at the batch level. Records of all invalid samples will be filed. Information will include a summary of why the sample was invalidated along with the associated flags. At least one flag will be associated with an invalid sample.

Validation of Measurement Values
Validation determinations will be made on a case-by-case basis. For example, if a flow rate verification was off by 6% (5% specification); a qualification flag would be assigned to the sample. However, this alone would not be cause to invalidate the sample. Data that is qualified with a flag, but not invalidated will be reported to AQS. Documentation of the flag will be kept on file. The flag will be reported to AQS if possible. Flagged data will be investigated to determine if corrective action is necessary.

Validation of Sample Batches
Flags will be assigned to batches. However, flagged data will be submitted to AQS. Documentation of the flag will be kept on file. The flag will be reported to AQS if possible. Flagged data will be investigated to determine if corrective action is necessary.

D3. Reconciliation with User Requirements

This ambient network has been collecting PM2.5 measurements for over 25 years. The technology and instruments used to collect the data has changed over time.

Before instruments were replaced, new equipment was collocated with the old. However, no attempt to evaluate pollution concentration change over time when the equipment changed is planned.

After the accumulation of many years of data a trend analysis will be conducted to determine if long-term changes are occurring. An effort to identify the source of change will be undertaken when needed. The number of instances when the monitoring information was utilized for calling burn bans will also be reported with quarterly reports to EPA Region 10. A discussion of effective data use will be added to the annual monitoring report. If there is a noticeable increase in PM2.5 concentration, that is not explained by events, such as wildfire, the Coeur d'Alene Tribe may improve this network and collect higher quality PM2.5 data.

Appendix A – Standard Operating Procedures

Calibration of a Streamline Pro™ MultiCal™ System

Scope and Application

1. This procedure applies to the following transfer standards: Chinook Engineering Streamline Pro™ MultiCal™ System, which is used in the Nez Perce Air Quality Project monitoring network.
2. The elements of this SOP are applicable for all sampling frequencies.

Summary of Method

1. The Nez Perce Air Quality Project is responsible for all quality assurance requirements in the network. This procedure will be contracted to a competent third party.
2. This procedure calibrates a field transfer standard (Streamline Pro) against a NIST-traceable primary standard, so the Streamline Pro can be used to perform field calibrations and accuracy audits of ambient air samplers.

Health and Safety Warnings

General safety precautions related to pneumatic and electronic equipment should be followed.

Cautions

1. Use caution around the inlet of the calibration bench, especially when the system is operating. Do not allow anything near the inlet of the bench, and restrain any loose clothing, hair, etc.
2. When working near electronic boards, use care that any static electricity is discharged prior to touching the board or any components
3. Damage to equipment may result if caution is not taken to properly install and operate the system.

Personnel Qualifications

1. Persons performing this SOP must be trained in the operation of metrology equipment, and traceability practices.
2. Computer skills are necessary for managing data.

Equipment

1. Temperature standards with current NIST-traceable certifications, and insulated, high thermal mass water baths.
2. Pressure standards with current NIST-traceable certifications, and barometric pressure chamber.
3. Calibration bench including air mover with flow rate controller, and leak free connections and mounting apparatus
4. Sonic nozzle calibration standard, NIST-traceable
5. Calibration data sheet and writing instrument
6. Computer with appropriate data input software

Calibration of a Streamline Pro Field Transfer Standard

1. Log in the unit including serial number.

2. Inspect the internal orifice element, O-rings and grommet; clean with a swab and methanol, replace any components if damaged or suspect. Note any problems and any service performed.
3. Record ambient temperature and pressure.
4. Install Streamline Pro on calibration bench. Prepare applicable water baths. Place both Streamline Pro temperature probe and NIST-traceable primary standard probe in center of water bath, stirring gently. When temperature readings are stable, input both readings into calibration software. Repeat for at least three readings across intended range of use. Check that all readings are within ±0.1°C of actual reading, correct situation if not.
5. Connect Streamline Pro barometer and primary standard barometer in parallel to leak tight barometric pressure chamber. Impose applicable pressure/vacuum and allow system to come to equilibrium. When pressure readings are stable, input both readings into calibration software. Repeat for at least three readings across intended range of use. Check that all readings are within ±2mb of actual reading, correct situation if not.
6. Turn on pump, perform calibration bench leak check. An acceptable leak rate is not greater than 8 mmHg/60 seconds with vacuum initially below 10 mmHg. Correct any excess leakage.
7. Adjust valve to first set point. Input Pin and Tin from calibration apparatus, and flow reading from Streamline Pro into calibration software. Repeat for all set points in calibration range. Check that all readings are within ±0.007lpm of actual reading, correct situation if not.
8. Check that all new internal calibration constants are stored properly in Streamline Pro Measurement Unit, and that the corresponding data file is saved and stored properly. Input calibration date.
9. Generate calibration report and certificate, return to appropriate party.

Monthly Verification and Field Calibration for BAM 1022 Ambient Particulate Monitoring System (Temperature, Pressure & Flow)

Scope and Application

1. The Coeur d'Alene Tribe Air Quality Program staff operates two continuous BAM 1022 analyzers to measure the ambient concentrations of fine particulate matter as PM2.5. BAM Samplers generate hourly concentrations and are used to evaluate acute incidents and short-term trends.
2. This procedure applies to the Met One Instruments BAM 1022. The BAM1022 is a Federal Equivalency Method for PM2.5 when a very sharp cut cyclone is used. The BAM 1022s used in this network are configured with a PM2.5 sharp cut cyclone rather than a very sharp cut cyclone and thus are a special purpose monitor, not a FEM. It is assumed that the basic construction, electronics, data input and output, and operating systems of the BAM 1022 samplers in this network are the same, and the elements of this SOP are applicable to all BAM 1022s deployed in this network.
3. This SOP describes the method for performing a performance verification of ambient temperature, barometric (ambient) pressure, and flow rate on a BAM 1022. Verifications are done on a monthly basis when units are operating.

Summary of Method

1. The Coeur d'Alene Tribe Air Quality Program is responsible for the monthly verification of its BAM 1022. Air Quality staff performs the actual procedure.
2. Performance verifications of ambient air, barometric pressure, flow rate, and leak check are performed and recorded on a monthly basis to assure compliance with sampler performance specifications.
3. Specifications are as follows:

Ambient temperature	±2°C
Barometric pressure	±10 mm Hg
Flow rate	± 4%
Leak check	≤ 1.5 lpm

4. If a sensor fails to meet verification specifications, a calibration is performed.
5. If sensor cannot meet calibration, the unit is returned to manufacturer for service and recalibration.

Flow Audit and Calibration

The accuracy of the BAM 1022 flow control system should be periodically verified. If the flow, temperature or pressure sensors are not operating within desired specification, they should be calibrated.
Required Tools: Certified Calibration Transfer Standard (CTS) (e.g. Flow Calibration Kit, Met One Instruments Part No. BX-307).
Minimum Suggested Interval: Complete calibration upon commissioning. Verification required after replacing filter tape (8 weeks).

All calibration transfer standards should be certified to the following criteria, and have a valid certificate of traceability to NIST standards.

Transfer Standard	Acceptance Criteria
Flow Rate	± 2% of NIST Traceable Standard
Ambient Temperature	± 0.1° C Resolution ± 0.5° C Accuracy
Barometric Pressure	± 1 mmHg Resolution ± 5 mmHg Accuracy

If a flow audit is desired (and not a full calibration) the same procedure detailed in this section is followed, but no changes are made; the results are observed and recorded only. A flow audit confirms operation of the flow system without making any alterations. This may be necessary to validate collected data.

During verification of the BAM 1022 flow control system, the following acceptance criteria should be maintained.

Parameter	Acceptance Criteria
Flow Rate	± 4% of transfer standard
Ambient Temperature	± 2° C of transfer standard
Barometric Pressure	± 10 mmHg of transfer standard
Leak Check	≤ 1.5 lpm

Use the following steps to verify and calibrate sensors associated with the BAM 1022 sample flow control system.

1. Make certain that the BAM 1022 has warmed up for at least 60 minutes prior to performing calibrations. Also, allow the calibration transfer standard (CTS) to equilibrate to ambient conditions for no less than 30 minutes.
2. Go to the Operate menu and select Stop Sample to stop the current sample.
3. Remove the size selective inlet(s) from the sample tube and install the calibration transfer standard (CTS).
4. Enter the Test > Ambient Temperature screen.
5. Compare the BAM 1022 temperature measurement and CTS temperature reading.
6. If the BAM 1022 temperature sensor exceeds the criteria listed in the table above, press the grey DEFAULT button to remove any previous offsets. If the temperature now passes, go to step 8.
7. If the temperature still needs to be adjusted, press the green bordered value box and the numerical entry keypad will be displayed. Enter the CTS value in the Standard field and press OK to return to the Ambient Temperature screen. Press the grey CALIBRATE button to enter the new calibration offset.
8. Return to the TEST menu and go to the Ambient Pressure screen.
9. Compare the BAM 1022 pressure measurement and CTS pressure reading.
10. If the BAM 1022 pressure sensor exceeds the criteria listed in the table above, press the grey DEFAULT button to remove any previous offsets. If the pressure now passes, go to step 12.
11. If the pressure still needs to be adjusted, press the green bordered value box and the numerical entry keypad will be displayed. Enter the CTS value in the Standard field and press OK to return to the Ambient Pressure screen. Press the grey CALIBRATE button to enter the new calibration offset.
12. Return to the TEST menu and select the Flow Calibration menu (see section 3.4.4).
13. On the Zero Flow test screen, verify the Flow value indicates 0.00 LPM. If it does not, press the grey ZERO button and confirm that the Flow value changes to 0.00 LPM.
14. Press the grey CONTINUE button to proceed to the Flow Calibration screen. The pump will start automatically and adjust flow to the 16.7 LPM test point.
15. Press the green bordered value box the flow rate test set point selection will appear.
16. Select the 14.0 LPM set point and then press the OK button. The display will return to the Flow Calibrate screen and adjust the flow to the new test point.
17. Allow the BAM and CTS reading to stabilize (at least one minute) and then compare the BAM 1022 flow measurement and CTS flow reading.
18. If the BAM 1022 flow rate exceeds the criteria listed in the table above, press the grey DEFAULT button to remove any previous offsets for all three flow settings. If the flow rate now passes, skip the next step.

19. If the flow rate still needs to be adjusted, press the green bordered value box and the numerical entry keypad will be displayed. Enter the CTS value in the Standard field and press OK to return to the Flow Calibrate screen. Press the grey CALIBRATE button to enter the new calibration offset.
20. Press SET to apply the change. When setting the 16.7 LPM flow rate, the SET option will change to read CALIBRATE.
21. Repeat steps 15 through 18 above for the 17.5 LPM flow rate.
22. Repeat steps 15 through 18 above for the 16.7 LPM flow rate.
23. Return to the Main Operating Screen and remove the CTS from the inlet tube and replace the size selective inlet(s).
24. Resume normal sampling operations.

Reference
BAM 1022 Particulate Monitor Operation Manual BAM 1022-9805 REV C

The following are to be noted in the field log book:

Site	
Sampler time	
Cell time	
Sampler Date	
Date	
As Found:	
Sampler Air Temperature (<2C criteria)	
Streamline Pro Temperature	
Sampler Barometric Pressure (10mm Hg criteria)	
Streamline Pro Barometric Pressure	
Turn off pump, remove PM10 inlet for leak check and flow	
Time pump off	
Leak Check (< 1.5 lpm criteria)	
Sampler Flow (16.0-17.3 lpm passing criteria)	
Streamline Pro-Flow	
If calibrate - do so after check AT, BP, Leak, and Flow	
If calibrate or adjust, record value as left "left"	
Parts cleaned	
Other notes	
Time pump turned on	

Audit sheet for BAM1022

Quality Assurance Audit of BAM1022 Sampler

Auditor:	Tyson Harris, Idaho Bureau of Laboratories		Site:		
Organization:	Nez Perce - Tribe		Audit Date:		
Sampler Model:	BAM 1022		Sampler S/N:		
Operator:	M. Fauci				
Sampler Time:		Audit Time:		Time Δ (± 5 min)	
Sampler Date:		Audit Date:		Date Δ (± 0 days)	
Audit Start (Data Logger time):			Audit Complete (Data Logger time):		
Audit Barometric Pressure (mm Hg)			Sampler Barometric Pressure (mmHg)	BP Δ (±10.0 mmHg)	
	Amb			Amb	
Sampler Temp (°C):		Audit Temp (°C):		Temp Δ (± 2° C)	

	Design (l/min)	BAM1020 (Sampler Qa)(l/min)	Audit (Audit Qa)(l/min)		Qa % DIFF	Design %DIFF
Total Flow	16.70					
Total Flow (Confirmation)	16.70					
					+/- 4%	+/- 5%

Monitor Condition / General Observations / Notes:	

Calculations

Time Δ = Sampler – Audit		BP Δ = Sampler – Audit		
Date Δ = Sampler – Audit		BP mmHg = BP atm * 760		
Temp (°C to °K) = °C + 273.2		BP atm = BP mmHg / 760		
Qa % DIFF = (Sampler Qa) – Audit Qa) / Audit Qa * 100%				
Design % DIFF = (Audit Qa) – Design Flow) / Design Flow * 100%				

Met One Instruments Weather Station

Procedural Section

Scope and Application
This Standard Operating Procedure (SOP) outlines the use, operations, and downloading associated with the Met One sensors.

Health and Safety Warnings
Always verify the condition of the equipment to be used before it is installed and/or operated. Damaged equipment or frayed wires should be replaced as soon as they are noticed to prevent electrical shock or other injury.

Interferences
Before shipment, Met One Instruments tested all sensors for their ability to measure accurately under most climatic conditions. No interferences should be expected if properly installed. The Met One Instruments System Test Certifications and Installation Instructions can be found in the Met One Meteorological Monitoring System Operation Manual.

System Audit
According to the manufacturer, a complete system audit should be performed on a semi-annual basis.

TECHNICAL ASSISTANCE/SERVICE
For technical assistance or, for service-related issues contact.

Met One Instruments
1600 Washington Blvd
Grants Pass, OR 97526
(541) 471-7111 phone
service@metone.com

Audit of a Meteorological Station

Meteorological Station Audit Worksheet

Meteorological Audit Worksheet			Audit Date:	
Site Name:	Lapwai Colocated		Site Operator:	M.Fauci
Location:	Lapwai		Auditor:	Tyson Harris, Idaho Bureau of Laboratories

Wind Speed Accuracy Test

Audit Speed (RPM)	Audit Speed (MPH)	Datalogger Output (MPH)	Difference (MPH)	Allowable Difference (MPH)
200	12.53	12.53	0.00	1.127
300	18.49	18.49	0.00	1.425
500	30.42	30.42	0.00	2.021
600	36.38	36.38	0.00	2.319
800	48.31	48.31	0.00	2.916
	Absolute Avg.		0.000	

Allowable Difference: +/- 5% of sampler reading + .5 mph. Audit reading has to fall within this range for sampler to pass audit.

Wind Direction Linearity Test
(All units in degrees °)

Audit Setting (°)	Dataloger Output (°)	Error (°)	Normalized Output (°)	Normalized Error (°)
20				
50				
80				
110				
140				
170				
200				
220				
250				
280				
310				
340				

** Dead zone on WD potentiometer - ° to °*

Average Error (°)				
Largest absolute normalized error (°): Acceptable Difference ± 3°				

Device Parameter	Model	Audit Value		Sensor Value	Diff. / Finding	Acceptable Difference (Sampler - Audit)
Datalogger Clock						± 15 Minutes Difference
Wind Direction Orientation Check	Met One 20C					Vane Alignment ± 5°
Barometric Pressure						± 15.0 mmHg Difference
				Convert inHg to mmHg = inHg * 25.4		
2 Meter Temp.					0.0	± 2.0 °C Mean Difference
				Convert °F to °C = (°F - 32)/1.8		
		RH		RH		
Relative Humidity						Audit ± 5% of Sampler
Wind Direction Torque Threshold	*Met One 20C*			g-cm Clockwise		≤ 6.5 g-cm (Model 020C)
				g-cm Counter Clockwise		
Wind Speed Torque Threshold	*Met One 10C*			g-cm Clockwise		≤ 0.3 g-cm (Model 010C)
				g-cm Counter Clockwise		

Rain Gauge	*Audit Tips & Volume based on sensor mL / Tip specs*	Tips	Volume (mL)	Tips	Volume (mL)	Sampler Vol.(mL) - Audit Vol.(mL) / Audit Vol.(mL)
						± 10% Difference

Notes:

Appendix B – Tables of Schedules Work

The following is a summary of the tables of the scheduled work that are referenced in the Quality Assurance Project Plan. This summary allows for a quick reference guide.

Quality Control and Accuracy Matrix

Activity	Frequency	Acceptance Criteria	Information Provided
Continuous BAM 1022 PM2.5 Measurement Systems - Verification			
Flow Rate	Monthly	± 4% of transfer standard	re-calibrate instrument
Ambient Temperature	Monthly	± 2° C of transfer standard	re-calibrate instrument
Barometric Pressure	Monthly	± 10 mmHg of transfer standard	re-calibrate instrument
Continuous BAM 1022 Measurement Systems - Calibration			
Calibration: ambient temperature barometric pressure, & flow rate	Initially, as needed	N/A	see Operating Manual
Continuous BAM 1022 PM2.5 Measurement Systems - Accuracy			
Flow Rate	Quarterly	± 4% of transfer standard	re-calibrate instrument
Ambient Temperature	Quarterly	± 2° C of transfer standard	re-calibrate instrument
Barometric Pressure	Quarterly	± 10 mmHg of transfer standard	re-calibrate instrument
Ambient (barometric) pressure audit	Once per year	±0.020 atmospheres	re-calibrate instrument

Summary of Project Measurement Quality Objectives

Parameter	Criteria	Frequency
Continuous Method for PM2.5 (BAM)		
Completeness	75% per instrument, per quarter	Quarterly
Verification, flow	±4%	Monthly
Verification, temperature	±2.0°C	Monthly
Verification, barometric pressure	± 10mm Hg	Monthly
Accuracy, flow	±4%	Quarterly
Accuracy, temperature	±2.0°C	Quarterly
Accuracy, barometric pressure	± 10mm Hg	Quarterly
Surface Meteorological Parameters		
Completeness	90% data recovery per quarter	Quarterly
Accuracy, temperature	±2.0°C	6 months
Accuracy, wind speed	0.25 m/s under 5 m/s, 5% over 5 m/s	6 months
Accuracy, wind direction	5°	6 months
Accuracy, barometric pressure	0.1”Hg	6 months
Accuracy, relative humidity	±5%, when 5%<RH<95%	6 months
Accuracy, precipitation	10%	6 months

Preventive Maintenance Schedule

Component	Item	Interval	Procedure/reference
BAM 1022 Instrument	Replace the filter tape	8 Weeks or as needed	Operating manual Sec. 4.2
	Basic leak check	8 Weeks	Operating manual Sec. 6.2
	Nozzle, vane and pinch roller cleaning	8 Weeks	Operating manual Sec. 6.6
	Flow audit (verify and/or calibrate flow system)	8 Weeks	Operating manual Sec. 6.4
	Clean PM10 inlet particle trap	As needed	Manual
	Clean PM2.5 cyclone particle trap As needed BX-808 Manual	As needed BX-808	Manual
	Verify or set the clock	8 Weeks	Operating manual Sec. 3.5.1
	Mass Audit	6 Months	Operating manual Sec. 6.8
	Background determination	Annually	Operating manual Sec. 6.5
	Internal Nozzle Cleaning	6 Months	Operating manual Sec. 6.7
	Replace the pump muffler	6 Months	n/a
	Test analog output voltage (if used)	6 Months	Operating manual Sec. 3.4.11
	Rebuild AC pump	As needed	BX-126 Manual
	Empty PM10 inlet water jar	As needed	n/a
Meteorological System	Wind sensor		
	RH / temp.		
	BP sensor		
	precipitation gauge		
	Wind Direction		
	Wind Speed		
	Datalogger		

Report Contents

Hard Copy Report	
Report Item	Contents
Network summary	Overview of network QA/QC activities and results, discussion of unusual events, problems, etc. Annually.
QA assessment summary	Completeness, precision, and accuracy assessment results. Quarterly assessments conducted annually.
Verifications, Audits, and Calibration report	Documentation of verification, audit and calibration, activities, PM2.5 accuracy estimates, random review. Quarterly.
Certifications	Documentation of certified standards. Annually.

Data Archive Policies

Data Type	Medium	Location	Retention Time	Final Disposition
Audit trail	Hardcopy	CDA Tribe	Indefinite	CDA Tribe AQP archive
Field notes & data sheets	Hardcopy	CDA Tribe	3 years	CDA Tribe AQP archive
Raw data	Electronic	CDA Tribe	5 years	Archived on AQP computer
BAM 1022 PM2.5 & meteorological data - QA checked	Electronic	CDA Tribe	Indefinite	Archived in AirVision database, AirNow, and AQS
Meteorological data	Electronic	CDA Tribe	Indefinite	Archived in AirVision database, AirNow, and AQS