QUALITY ASSURANCE PROJECT PLAN FOR UTE MOUNTAIN UTE AIR QUALITY PROGRAM

High Volume
PM10

This work was supported by the Clean Air Act Grant 103 from US EPA Region 8.

QAPP – UTE MOUNTAIN UTE TRIBE IDENTIFICATION AND APPROVAL ELEMENT 1 (A1).

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TABLE OF CONTENTS ELEMENT 2 (A2)

DISTRIBUTION LIST ELEMENT 3 (A3)

Paper copies of this QAPP have been distributed to the people listed in the **Distribution List**. Revised sections or the entire QAPP are sent to these people.

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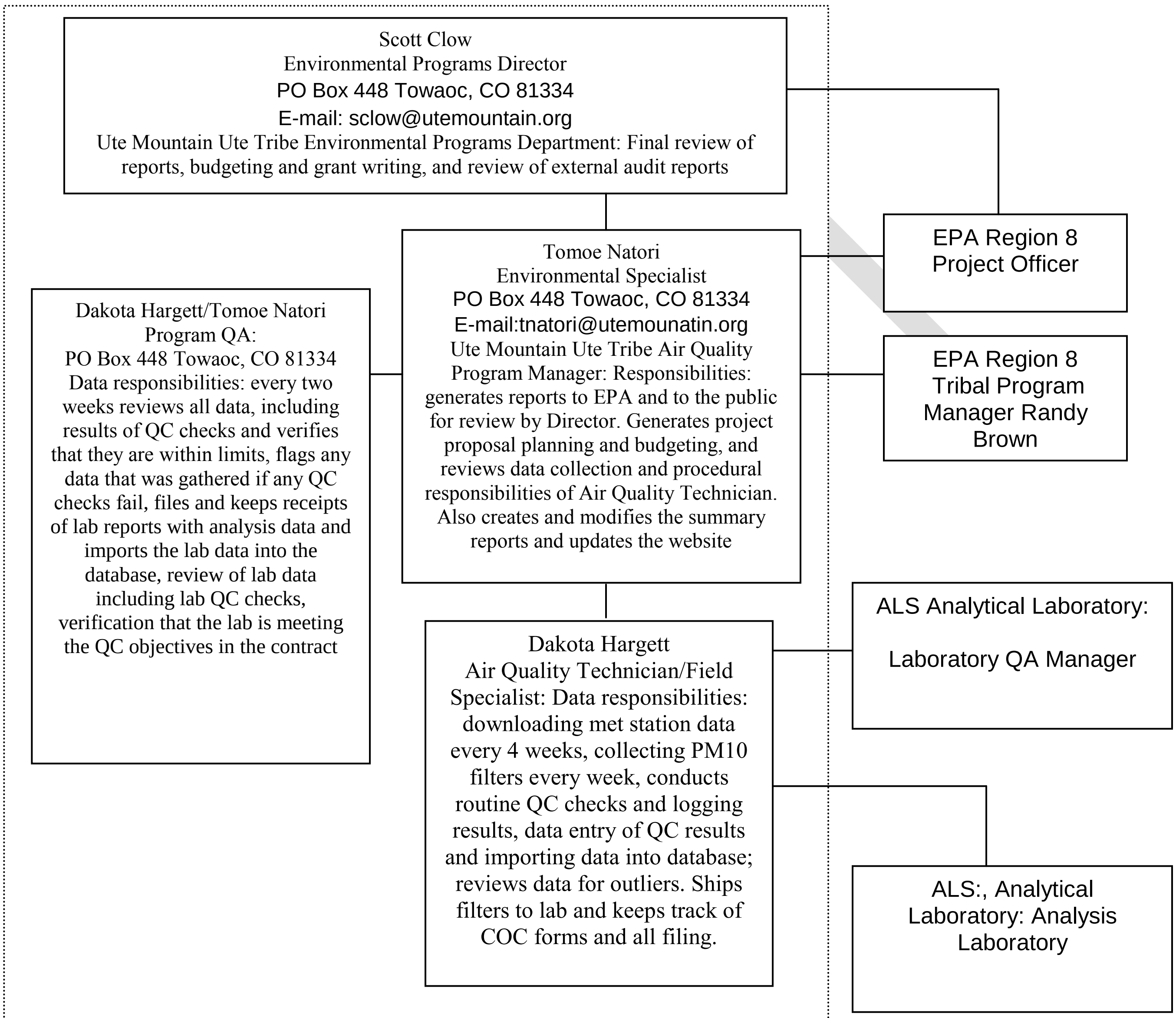
Pollutant: PM10 - Filter based local conditions

PROJECT ORGANIZATION ELEMENT 4 (A4)

Assignment: Organizational Chart Ute Mountain Ute Tribe Air Quality Program



* if there are insufficient personnel to assign a different person to the task of QA Manager, there needs to be some provision made for the person to “disconnect” their roles of data gathering and QA manager. This may be done by allotting one day (for example) every five or ten days to QC tasks such as reviewing the status of files, data,

I. PROBLEM DEFINITION/BACKGROUND ELEMENT 5 (A5)

The Environmental Programs Department is initiating regular PM10 - Filter based local conditions monitoring as part of an area source environmental protection effort in addition to EPA recommended meteorological data. Tribal goals for environmental protection are to protect human health and natural resources. The objective of the ambient air Monitoring Program is to characterize ambient air conditions by chemical speciation for radioactive particulates where ambient air quality measurements are made. The ambient air monitoring data are then used to support the Ute Mountain Ute air monitoring program. The ambient air monitoring station will be located in White Mesa, Utah. Locations of the analyzers and the rationale for these locations can be found in the following sections. This QAPP describes project methods, refers to EPA-established data quality objectives, and defines data quality assurance and control methods for air monitoring by the Environmental Programs Department. The QAPP was developed to ensure consistent, repeatable results and to improve the reliability and comparability of data collected. This project was developed in response to growing concerns about air quality from the transport and dispersal of radioactive dust, volatile organic compounds and other hazardous air pollutants from the nearby Uranium and Vanadium Mill, White Mesa Mill (The Mill).

II. PROJECT DESCRIPTION ELEMENT 6 (A6)

The measurement goal of this ambient air quality monitoring program is to estimate the activity, in units of picocuries per filter, of radioactive laden particulate matter with mean aerodynamic effective diameter less than 10 microns in the ambient air characteristic of the air breathed on tribal land. The primary goal is to establish baseline measurements through selective analysis of the filter, including heavy metal laden particulates, more specifically Uranium and those metals associated with the Uranium decay series including Thorium, Radium, and Lead. Measurements will be performed by using a filter that has been carefully handled according to the Ute Mountain Ute Tribe’s QA/QC protocol, set to collect particulate matter using an American Ecotech MegaVol PM10 collector for 24 hours at $3,600m^3$ to then be sent to ALS, a speciation laboratory for selective analysis. Data collected will be closely correlated with meteorological measurements to accurately qualify conditions in atmospheric variability to particulate matter collected. The results will also be closely checked for comparison to the semi-annual effluent monitoring report of White Mesa Mill. QC checks will be made before and after each measurement. The measurements are made to estimate human exposure and will be made in accordance with EPA and the equipment manufacturer's recommendations. The performance requirements of the analyzer have been specified in Appendix D of 40 CFR Part 50. Measurements will be made at locations described in Section 7. Measurements will be obtained for time periods at one-in-seven day intervals, after initial dry runs with the equipment and system. Guidance from the Department of Energy’s (DOE) Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance document is also noted and

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referenced for quality control procedures. Other prospective studies for our environmental protection effort will include atmospheric transport and diffusion computations and dose assessments for radionuclides that have the potential to harm populations.

Project location

North Pump House White Mesa, Utah

North Pump House, White Mesa, Utah
Facing N/NW, the direction of the Mill

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View of the smoke stack, White Mesa Mill. Emissions from the high temperature U_3O_8 drying ovens include VOC's, ammonias, acids and particulate matter.

III. QUALITY OBJECTIVES AND CRITERIA FOR MEASURING DATA- ELEMENT 7 (A7)

Stating the problem: Element 7a (A7-1)

There has been concern recently that air quality conditions have deteriorated on tribal land from White Mesa Mill just three miles North of White Mesa Ute community. This office has received complaints about acidic and rusted metal smells, particularly in the morning and evening, increased cancer rates among young adults and children, and instances in which people will not graze their animals on the land or drink the water for fear of radioactive contamination. We have sufficient evidence to monitor air quality due to the Environmental Programs Departments past studies on surrounding radionuclide analysis on water, sediment and vegetative sampling that have suggested off site migration of uranium particulate. The Ute Mountain Ute tribe had requested the U.S. Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS) to perform an independent evaluation of the potential offsite migration of radionuclides and trace elements associated with the ore storage and milling process to tribal members from various exposure pathways. Potential air- and water-exposure pathways of uranium and other trace elements to tribal members include (1) airborne dust from uncovered ore storage pads, (2) airborne emissions from the mill's drying ovens, (3) dissolution of airborne dust deposited on soil and plant surfaces, (4) transport of material from the ore storage pads that are eroded into ephemeral channels draining the mill site during rain and snowmelt events, and (5) leakage from the tailings ponds to shallow aquifers beneath the mill, resulting in offsite migration toward the reservation (David L. Naftz, 2010) . We do not have information on air quality, and if conditions continue to change we will not be able to track whether changes in health and radioactive distribution are correlated to the Mill.

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White Mesa Mill

White Mesa Mill has been in operation since 1980 for the conventional processing of Uranium ore for the production of yellow cake (U_3O_8) in addition to a byproduct Vanadium (V_2O_5) recovery circuit. The mill uses sulfuric acid (H_2SO_4) leaching and a solvent extraction recovery process to extract and recover the U_3O_8 and V_2O_5. The mill is licensed to process an average of 2,000 tons per day of ore and produce 8.0 million pounds of U_3O_8 per year, in addition to receiving and processing alternative feeds. The Mill is considered an area pollution source which includes evaporative tailings ponds, ore storage pads and high temperature smokestacks from the drying of U_3O_8. The ore delivered to the Mill from the Colorado Plateau has a typical U_3O_8 grade of 0.25-0.30%, naturally occurring yellow cake, following processing is concentrated to around 90% U_3O_8. The ore remaining after processing or sludge retains around 85% of its initial radioactivity arising from thorium-230 and radium-226. Destined for the solid tailings cells, the sludge contributes the largest source of radon-222 emissions on the Mill site. With a total of 2,000 tons of ore delivered on site per day, ore piles rapidly accumulate, contributing the largest source to offsite migration of radionuclide laden particulate matter. The Mill is required by the Nuclear Regulatory Commission (NRC), the Department of Radiation control (DRC) and the Department of Environmental Quality (DEQ) to monitor the ambient air for subsequent analysis of the filters at five different locations within the Mill's property boundaries. Filters are collected on a weekly basis, averaged for a month, and released as a semi-annual effluent reports on a quarterly basis. The reports have sporadically been submitted to the Ute Mountain Ute Tribe for review, based on our inquiries, where no alarming levels of radionuclides have been presented. Their analysis includes total Uranium 238, Thorium 230, Lead 210, Radium 226, and total alpha emitted radiation, of which the Ute Mountain Ute Tribe's Air Quality Program will emulate. The quality control and quality assurance documents of the Mill are inaccessible, and thus questionable in terms of data validity.

Identifying the decision: Element 7b (A7-2)

The purpose of this air monitoring effort is to gather data for two purposes: first, to assess by selective analysis the radionuclide content of particulate matter in ambient air in picocuries/m^3, and second to serve as baseline data so that changes in air quality can be tracked. If air quality is found to exceed healthy naturally occurring radioactive levels, as set by the Nuclear Regulatory Commission's (NRC) Radionuclide Table 2, 40 CFR Part 61 Appendix E, the Code of Federal Regulations (CFR) National Emission Standards for Hazardous Air Pollutants (NESHAPS) 10 CFR Part 20 Appendix B, and the Utah Administrative Code (UAC) Standards for the Protection Against Radiation R313-15 respectively. Based on data collected, the decision that will be made is whether to make further measurements at differing locations to determine more specifically the migratory route and source of high pollutant concentrations. In addition, atmospheric and diffusion computations to calculate dose assessments may be done, as well as radionuclide' mapping' of hotspots around the area.

Identify the inputs to the decision: Element 7c (A7-3)

The inputs to the decision are the data that are gathered. At this point no other data will be gathered specifically for this project besides PM10 and meteorological measurements. The data that will be gathered will be in accordance with all EPA recommendations and industry practice in terms of schedule, siting, etc. so that the data will provide accurate results.

Deciding on a decision rule: Element 7e (A7-5)

If it is determined that the air quality exceeds minimum radionuclide concentration of primary health concern as set by the CFR, UAC and EPA, or if our results differ from the recorded semi-annual effluent air quality reports of the Mill, we will confer with tribal council and other tribal leaders to determine the best course of action. At a minimum, we will request additional funds from EPA to conduct more intensive monitoring to determine the exact migration of the elevated levels, integrate processes to mitigate those levels, relocate the existing monitors, or increase the monitoring frequency if feasible and purchase additional monitors.

Optimize the design: Element 7g (A7-7)

The design has been optimized to fit the budget and the needs of the tribe. The site location would have ideally been isolated on the reservation boundary, the point closest to White Mesa Mill, to correlate our findings with the Mill's effluent reports. Funding limited this decision due to construction for fencing, power, etc., thus the monitor is located at an already existing enclosure with an existing power source. If the site location changes, proper changes to the QAPP will be made.

IV. DATA QUALITY INDICATORS

Precision: Element 7h (A7-8)

For PM manual methods, there are two ways to estimate precision. The first way is to use the PM mass results of the side-by-side measurements made with two samplers next to each other and assess how different they are over time. If the results of one sampler are always "high" or always "low" then there is obviously a bias between the two. If the two samplers show results with sometimes the primary sampler higher than the collocated sampler, and sometimes the primary sampler lower than the collocated sampler, then there is no clear bias but just precision error. It is the average difference over time (both high and low) that is the estimate of precision error.

The second way to estimate precision for manual PM measurements (and for all instruments when a collocated sampler is not available), is to track the random variability in flow rate. This is generally the most important contributor to precision error. Note if we have collocated instruments, this variability in flow rate happens with both instruments, and this contributor to precision error is included in the larger precision error of the relative percent difference between the two instrument results.

Bias: Element 7i (A7-9)

Bias is estimated by evaluating our measurement results against a known standard used as the "true" value. It is expressed as a positive or negative percentage of the "true" value. Bias in this program is measured by comparing results of the flow rate of the instruments used by the tribe to the flow rate measured using a flow rate transfer standard that is not calibrated using the same primary calibration standard as those used to calibrate the tribe's instruments. In other words, a flow rate transfer standard used by another tribe, the EPA region or its contractor, or a contractor may be used to compare against the flow rate measured by the tribe's equipment, as long as that external flow rate measurement was made using equipment not calibrated with the same primary calibration source. Since there is no “standard” for PM, flow rate is the best representation of PM; this works because the PM on the filter is directly proportional to the flow rate through the filter. So, if the flow rate is ten percent low then the PM per volume gathered will also be ten percent low. The difference between the flow rate measured with the PM instrument operated by the tribe and the flow rate measured using the outside source is used as the estimate of bias.

Representativeness: Element 7j (A7-10)

Representativeness is defined as a measure of the degree which data really represent some characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. The representativeness of measurements made in this program is ensured by following EPA siting guidelines, and is fully explained in element 10. The goal of our program is to measure the pollutant concentrations that most people in our community actually breathe, and to do that we have been very careful in determining where to site our monitor(s). EPA's guidelines in 40 CFR 58 Appendix D, which include pollutant-specific recommendations for siting for various objectives and for various scales of representativeness, has been carefully reviewed and taken into account when siting our instruments.

Detection Limits: Element 7k (A7-11)

A detection limit is defined as the lowest value that a procedure can reliably discern. In other words, the level below which the instrument cannot discriminate from zero. Because there is always variation in any measurement process (precision uncertainty), even when measuring ozone in “clean” air,” for example, the level of detectability depends on how much precision error is in the process. Most instruments also have upper detection limits, but these are unlikely to cause a problem when one is measuring pollutants in ambient air. The detection limit for radionuclides here are 1 x 10^-16 µCi/ml.

Completeness: Element 7l (A7-12)

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50). Our program goal for completeness is 75% or greater.

Comparability: Element 7m (A7-13)

Because of EPA's strict requirements on the monitor types, analyses, and sampling procedures, which our program is following, EPA has helped to ensure adequate comparability. In addition, we have researched what other programs are doing in terms of general practices, and obtained example Standard Operating Procedures from other organizations using the same type of equipment, to help ensure that our results will be comparable to those gathered in different parts of the country.

Accuracy: Element 7n (A7-14)

Accuracy has been a term frequently used to represent closeness to truth and includes a combination of precision and bias uncertainty components. Accuracy should be used when a standard, such as a flow rate or other standard is used to compare against the equipment routinely used by the tribe. This will most likely occur only during audits. In this program, accuracy (total error) is estimated using the results of the performance audits described in section 14 (Performance Evaluations, and Independent Audits) and in the tables in element 14. A performance audit is conducted with a measurement system that has been calibrated with a different standard than that used to calibrate the field equipment, and by an operator other than the routine site operator. Because of this, the differences in results between the performance audit and the field instrument's result, as average over all the times such performance evaluations have been conducted, should represent our best estimate of the inaccuracies of our measurement system.

V. SPECIAL TRAINING / CERTIFICATION ELEMENT 8 (A8)

Workshops and courses hosted by ITEP and other similar resource agencies will be made available to project personnel. Records on personnel qualifications and training are maintained in personnel files and are accessible for review during audit activities. Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. Training is aimed at increasing the effectiveness of employees and the Environmental Programs Department. 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. The Air

Quality Program also monitors the availability of training courses offered by EPA's Air Pollution Training Institute and Region 6 facilities, Northern Arizona University's Institute for Tribal Environmental Professionals (ITEP), and private consulting firms. Such institutions conduct professional services and ensure certification of their courses offered. When circumstances warrant, staff members may be enrolled in one or more training courses offered by these institutions.

VI. DOCUMENTS AND RECORDS ELEMENT 9 (A9)

It is critical that management understand that properly documenting the project's activities takes time. The Environmental Programs Department air monitoring network is being established to assess the regulatory and compliance parameters of the Mill, and those associated health risks to the White Mesa Community. The air monitoring program 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 6.1, 6.2 and 6.3. The categories listed in parentheses in the first column of the table are taken from the Redbook Technical Systems Audit long form (Appendix 15 of EPA 454/R-98-004).

Each set of records that is often used is listed on a master file location/accessibility map showing where these files are, by whom they are accessible, and procedures for checking out files. This file map is posted to allow easy revisions and locations of the files. Our office keeps a list of official air program files, who is responsible for each file, and where each file is located. This list is posted so that when improvements and additions are made they can be noted on the list so that others can find the files. On this list are specified which files are to be left in the file folders at all times, and when removed their places are marked. These files may be removed but only after (1) copies are made and replaced in the file, or (2) the person responsible for that file has established a system for removal such as noting on a file folder cover page who and when has taken the file.

Documentation and Records for Planning Organizational Chart:

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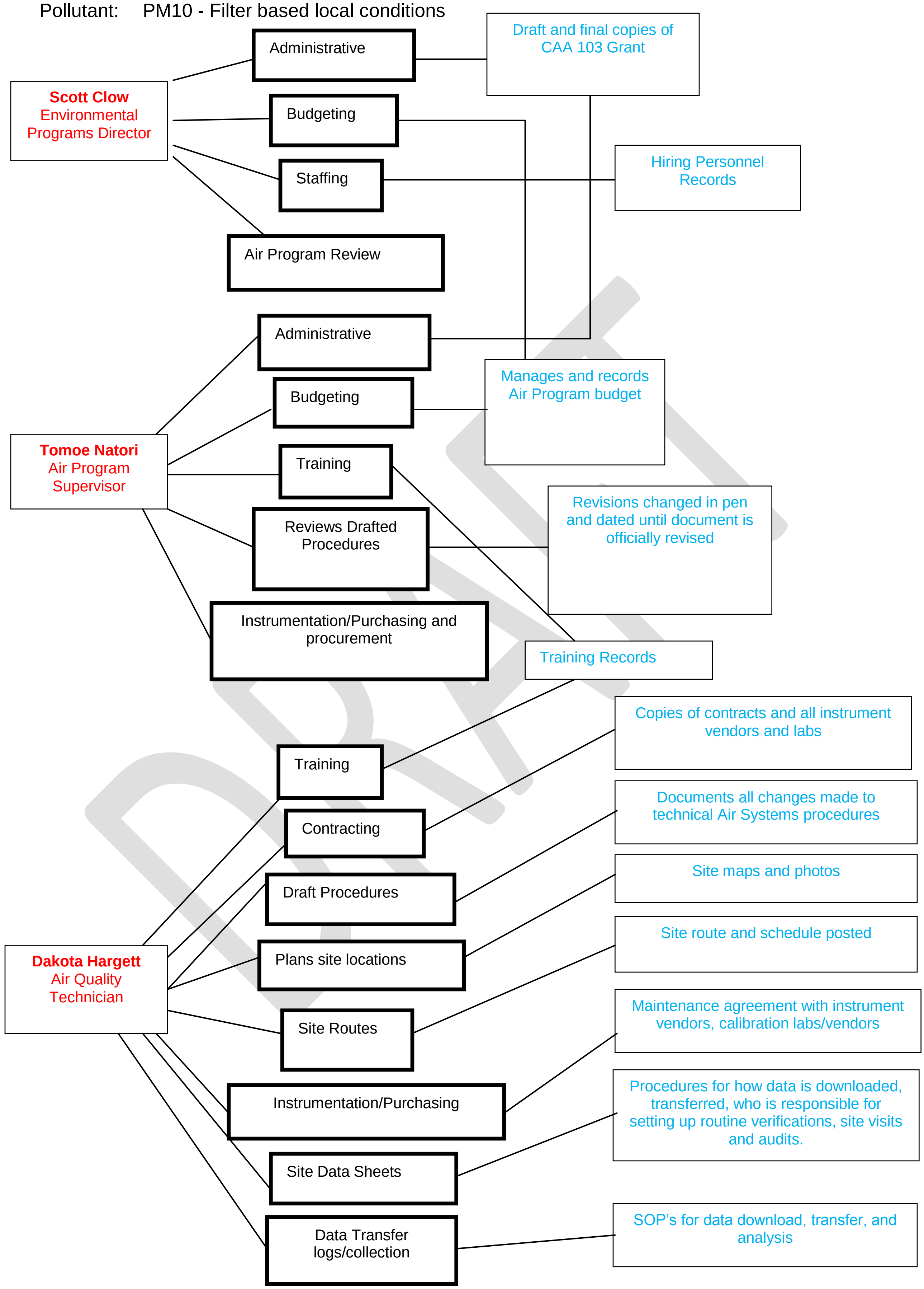

Pollutant: PM10 - Filter based local conditions

9-2 Documentation and Records for Project Operations

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Initial readiness review (internal audit)	Copy of readiness review report/checklist	Audit file (this is filed as a subcategory Of the internal audit file)	Audit reports or memos (or copies of notes) reviewed and filed by Air program Supervisor/Director	Within 30 days
Operations-Assessments and Audits: Periodic (quarter, semiannual or annual)	Audit Report	Audit file (this is a subcategory of the external audit file)	Reviewed by Environmental Programs Director	Within 30 days after the audit is complete
Operations-Data gathered/received: Data transfer from analyzer	Data on disk/paper	Instrument download log or log sheet (keep in disk, paper, and computer in parallel and according to file structure and naming conventions)	Filed by Air Program Supervisor Air Quality Technician	Every 2 weeks
Operations-Maintenance	Check instruments, such as pump, lines, leaks as specified by instrument manual	Site log with notes of what was checked and results of the checks- 3-ring binder for that site	Air Quality Technician	At least every 2 weeks
Operations-Shipping/Receiving	Logs for shipping and receiving set up	Shipping/receiving file stores copies of shipping papers, the logbook contains notes of shipments made/received	Air Program Supervisor Air Quality Technician	As items come and go
Operations Site QC checks	QC check sheet Flow rate parameters and sensors as specified in SOP's	Site log, and weekly QC checklist posted in shelter/inside door of unit and checked off with dates and initials	Air Quality Technician, initialed and dated both in site log and checklist	The results of QC checks are reviewed during every site visit
Operations-Calibrations	Information on calibration data sheet Notes	Calibration data sheet, Site Log, and Personal log	Air Quality Technician	Annually or as needed, shown by QC checks

Data Review Documentation Guidelines: Element 9e (A9-5)

A. Some portion of the final data (at least five percent) is conducted by hand, including collecting and checking site logs, maintenance sheets posted in shelters. In order 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 of 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.

B. Automation of the data review process is implemented to reduce manual error and increase speed.

Pollutant: PM10 - Filter based local conditions

This may be done in a variety of programs, including Excel or Access, 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.

C. Data validation should produce a report or completed checklist indicating which documents, reports, files, and sheets were reviewed and the reason(s) for invalidation of any set of data.

VII. SAMPLING DESIGN METEOROLOGICAL STATION- ELEMENT 10 (B1-i)

Campbell Scientific Meteorological Station

The meteorological station utilized by the Ute Mountain Ute Tribe's Air Quality Program is a Campbell Scientific model tripod with four sensors including six parameters for measurement. The sensors include temperature, relative humidity, precipitation, wind speed, wind direction and barometric pressure. A comprehensive list of the model numbers and specifications are presented below along with calibration and accuracy criteria for verifications and audits.

Sensor/Datalogger	Temperature	Relative Humidity	Precipitation	Wind Speed/Wind Direction	Barometric Pressure	Datalogger
Model	CS-HMP60	CS-HMP60	CS-TE525	RM Young-05103	CS106	CR200X

Detailed instructions for procedural methods in conducting annual/biannual verifications and audits are contained in the meteorological station SOP's.

Table 10.1: Modeling Application Calibration and Accuracy Criteria

Measurement	**Type**	**Acceptance Criteria**	**Frequency**	**Type**	**Acceptance Criteria**	**Frequency**
Temperature	3 pt. water bath with NIST-traceable thermistor or thermometer	+/-0.5°C	Semi-Annually Once every six months for independent audits	3 pt. water bath with NIST-traceable thermistor or thermometer	+/-0.5°C	Semi-Annually
Relative Humidity	NIST-traceable Psychrometer or standard conditions	+/-7% RH	Semi-Annually	NIST-traceable Psychrometer or standard conditions	+/-7% RH	Semi-Annually
Precipitation	Separatory funnel and graduated cylinder	+/-10% of input volume	Semi-Annually	Separatory funnel and graduated cylinder	+/-10% of input volume	Semi-Annually

Pollutant: PM10 - Filter based local conditions

Wind Speed	NIST-traceable Synchronous Motor, CTS method	+/-0.2 m/s	Semi-Annually	NIST-traceable Synchronous Motor	+/-0.2 m/s	Semi-Annually
Wind Direction	Solar Noon, GPS, Magnetic Compass, CTS method	+/-3-5 degrees	Semi-Annually	Solar Noon, GPS, Magnetic Compass	+/-3-5 degrees	Semi-Annually
Pressure	NIST-traceable Aneroid Barometer	+/-3mb	Semi-Annually	NIST-traceable Aneroid Barometer	+/-3mb	Semi-Annually

VIII. SAMPLING DESIGN HIGH VOLUME PM10 ELEMENT 10 (B1-ii)

The PM inlet should be as close as possible to the breathing zone, and must be 2 to 15 meters above ground level. The inlet must also be located more than one m vertically and two meters horizontally away from any supporting structure. There must be at least 10 m from the inlet to the drip line of any tree when the tree acts as an obstruction, and should be 20 m from the drip line of any tree.

Any site, 2 to 15 meters high and further back than the middle scale requirements will generally be neighborhood, urban or regional scale. For example, according to Figure E-1 of 40 CFR 58 Appendix E, if a PM sampler is primarily influenced by roadway emissions and that sampler is set back 10 meters from a 30,000 ADT (average daily traffic) road, the site should be classified as microscale, if the sampler height is between 2 and 7 meters. If the sampler height is between 7 and 15 meters, the site should be classified as middle scale. If the sample is 20 meters from the same road, it will be classified as middle scale; if 40 meters, neighborhood scale; and if 110 meters, an urban scale.

The inlet must be located away from obstacles and buildings such that the distance between the obstacles and the inlet is at least twice the height that the obstacle protrudes above the inlet, unless the site is a middle scale site. The inlet would be considered to be obstructed if an imaginary line extended 30 degrees up from the horizontal and rotated 360 degrees intersects any obstruction within 30 meters. Airflow must be unrestricted in an arc of at least 270 degrees around the inlet, and the predominant wind direction for the season of greatest pollutant concentration potential must be included in the 270 degrees arc. If the inlet is located on the side of a building, 180 degrees of clearance is required. An exception to this requirement can be made for measurements taken in street canyons or at source-oriented sites where buildings and other structures are unavoidable.

The inlet should be away from minor sources such as furnace or incineration flues. The separation distance is dependent of the height of the minor source's emission point (such as a flue), the type of fuel or waste burned, and the quality of the fuel (sulfur, ash, or lead content). This is to avoid strong influences on the PM concentration from these sources over a short distance.

Pollutant: PM10 - Filter based local conditions

Collocated monitors must be within 4 m of each other and at least 2 m apart for flow rates greater than 200 liters/min or at least 1 m apart for samplers having flow rates less than 200 liters/min so that the two samplers' air flows do not interfere with each other.

Number of Sites

The procedure for siting the monitors to achieve the basic objectives is based on convenience of location for power source, protection from vandalism and ease of access. Knowledge of diffuse and point source emissions is available, though, with the exception of meteorological data, no existing monitoring networks with current usable data are obtainable. The site is located within the White Mesa community and complies with site location requirements in terms of distance from high density traffic areas, trees and other obstructive structures. This method of sampling is thus based both from the combinational criteria of judgmental sampling and random sampling.

Table 10-2 Site Monitor Design Summary

Site Number	Monitor Number	Method Name	Monitor Objective	Sampling Frequency	Scale
Site 1	PM 10-Filter based local conditions	American Ecotech MegaVol 3000	To Characterize concentrations of radionuclide laden particulate matter for health and welfare	Frequency of monitoring is dependent upon the objectives. In this case, monitoring is being conducted to monitor and quantify the amount of particulate matter accumulated	Middle

Table 10-3 Project Schedule

Monitor	**Meteorological Station**	**Mega Volume PM10**
Collection Frequency	Once a month	Once per week until amount collected is verifiable to amount needed for analysis
Data Procurement	Data downloaded to laptop and stored in two locations. Analyzed alongside PM10 measurements	Filter and chain of custody sent to laboratory for analysis. COC forms kept in office for three years.
Laboratory Schedule	N/A	Filters sent to laboratory with Chain of custody form, while new filters are collecting samples

IX. SAMPLING METHODS ELEMENT 11 (B2)

Each sampler will be installed with adherence to procedures, guidance, and requirements detailed in 40 CFR Parts 50, 53 and 58; Section 2.11 of the QA Handbook; the sampler manufacturer's operation manual, and the SOPs in this QAPP.

X. SAMPLE HANDLING ELEMENT 12 (B3)

Chain of Custody

One of the most important values in the sample custody procedure is the unique filter ID number. The filter ID is an alphanumeric value.

12.1.1 Pre-Sampling Custody

The proper chain of custody form from the contracting laboratory is used with signature, date, time and volume of air collected. The filter ID number is recorded as sampling is begun.

12.1.2 Post-Sampling Custody

The field sampling SOPs specify the techniques for properly collecting and handling the sample filters. Upon visiting the site:

- Select the appropriate Filter Chain of Custody Record. Ensure that the Site ID and the protective Container ID(s) are correct.
- Remove filter from the sampler. Briefly examine it to determine appropriate filter integrity flag and place it into the protective container per SOPs.
- Place the protective container(s) into the shipping/transport.
- Record “Post Sampling Filter Recovery Information” on the PM_{10} Filter Chain of Custody Record.

Exposed filters will be shipped back to the lab as soon as possible. The site operator will send the sample to the laboratory. Pre-addressed mailing slips will be made available for site operators. Shipping requirements include:

- Notify courier for pick-up.
- Fill out the “Shipping Info” on the Filter Chain of Custody Record(s).
- Photocopy the Filter Chain of Custody Records that pertains to the shipment.
- Place the photocopied records in a plastic zip lock bag and include it in one of the shipping/transport containers.
- Seal all shipping/transport containers per SOPs.
- The site operator will take the original Filter Chain of Custody Records(s) and attach the air bill to the records.
- The site operator will contact the receiving laboratory of a shipment the day of the shipment.

12.1.3 Filter Receipt

Upon receipt of the exposed filters, the laboratory personnel will:

- Receive shipping/transport container(s)

Upon receipt, open the container(s) to find PM_{10} Filter Chain of Custody Record(s) or collect the originals from the site operator (if delivered by operator).

Fill out the "Filter Receipt" area of the PM_{10} Filter Chain of Custody Records(s). Check sample container seals.

XI. ANALYTICAL METHODS-ELEMENT 13 (B4)

Table 13.1 Analytical Methods

ALS Laboratory operates the radiochemistry laboratory in compliance with Colorado State Rules and Regulations Pertaining to Radiation Control. Details for the methodologies used are found in a copy of the Standard Operating Procedures (SOP's) of the lab held in office.

Contracted By	Filter	Radionuclide	Analytical Method	Reporting Units
ALS Labs	Watman 8"x10"	Lead-210	Gas Flow Proportional Counting	µCi/mi
ALS Labs	Watman 8"x10"	Radium-226	Gas Flow Proportional Counting	µCi/mi
ALS Labs	Watman 8"x10"	Thorium-230	Alpha Spectrometry	µCi/mi
ALS Labs	Watman 8"x"10"	Uranium-238	Fluorometry	µCi/mi

Method Description

Attached as laboratories SOP's to this QAPP

Laboratory Requirements

Attached as laboratories SOP's to this QAPP

XII. QUALITY CONTROL REQUIREMENTS ELEMENT 14 (B14)

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the tribe. Day-to-day quality control is implemented through the use of various checks or instruments that are used for comparison. A Quality Control Table summarizes the field QC procedures that will be followed. Criteria are Critical, Systematic or Operational and are shown in the tables 10-1, 10-2 and10-3.

Table 14-1 Critical Criteria

Requirement	Frequency	Acceptance Criteria	Information/Action
Filter, filter integrity, both before and after sampling, and filter recovery should be as soon as possible after sampling	Inspect every filter	No defects	

Pollutant: PM10 - Filter based local conditions

Sampling instrument, Average Flow Rate	Every filter	+/-10% of inlet design flow rate	
Sampling Instrument, Sample Run Time	Every filter		
Sampling instrument, Monthly 1 point flow check	Monthly; and if flow rate is stable after six months then this check can be done only once every 3 months	Within +/-7% of transfer standard's flow rate	If fails, then recalibrate
Sampling instrument, elapsed timer check	Every 6 months	+/-14 minutes for weekly run time	If fail, adjust or repair
Sampling instrument, quarterly on/off timer check	Every 6 months		

Table 14-2 Operational Criteria

Requirement	**Frequency**	**Acceptance Criteria**
Sampling Instrument, multi-point verification	1/year or if monthly checks fail	At least 3 points within +/- 10% of design flow rate
Sampling Instrument, Flow Rate (FR) 5-point calibration	If needed as shown by 5-point verification	+/- 2% of transfer standard for EVERY point
Lab QC Checks, zero check before and after each filter	Applicable to every filter	(air office must obtain this information from laboratory via reports within <= +/- 0.5mg of true zero and +/- 1-5 mg with 1-5 g check weights
Recertification against NIST primary standards	Annually	As per certificate issued by certification lab
Collocated samples, simultaneous filters by two samplers placed 2-4 m from each other	Every 12 days for 15% of sites	<= 10% relative percent difference where both values > 15 mg/m3

Routine Maintenance

1. Inspect all gaskets (including motor cushion) to assure they are in good shape and that they seal properly. For the PM-10 Inlet to seal properly, all gaskets must function properly and retain their resilience. Replace when necessary.

2. Power cords should be periodically inspected for good connections and for cracks (replace if necessary).

CAUTION: Do not allow power cord or outlets to be immersed in water.
3. Inspect the filter screen and remove any foreign deposits.

4. Inspect the filter media holder frame gasket each sample period. This gasket must make an airtight seal.

5. Insure the elapsed time indicator is operating by watching under power.

Table 14-3 Systematic Criteria

Requirement	**Frequency**	**Acceptance Criteria**
Data Completeness, and rounding convention	Quarterly	>=75%, and rounded quarterly to the nearest 10, with

		values greater than 5 rounding up)
Standards Recertifications, Field Thermometer	1/yr	0 to 50°C to the nearest 0.1 °C
Standards Recertifications, Field Barometer	1/yr	+/- 1 mmHg
Standards Recertifications, Standard Barometer accuracy		+/- 5 mmHg
Standards Recertifications, orifice transfer standard (e.g., top-hop orifice, variable orifice, or reference flow [ReF] device)	1/yr	+/- 2% of the NIST-traceable primary standard
Standards Recertifications, Clock/timer Verification	4/yr	Accurate +/- 1 min/month

14-4 Equations-Element 14d (B5-4)

$$d_i = \frac{X_i - Y_i}{(X_i + Y_i)/2} \times 100$$

Relative Percent Difference. When two FRM samplers are placed side-by-side for comparison of results, calculate the relative percent difference di, where Xi is the concentration measured by the primary sampler and Yi is the concentration value for the collocated or QC sampler.

$$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{2n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$$

Coefficient of Variation Upper Bound. Calculate the coefficient of variation upper bound where n is the number of valid pairs being aggregated, and X 0.1,n-1 is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom. The factor of 2 in the denominator adjusts for the fact that each di is calculated from two values with error.

$$d_i = \frac{Y_i - X_i}{X_i} \times 100$$

Assessment for One Point Flow Rate Verifications. For each verification check of flow rate with a standard calculate the percent difference between the samplers flow rate and that indicated by the standard, using equation 1 where Yi is the samplers flow rate and Xi is the flow rate from the audit instrument.

$$|bias| = AB + t_{0.95,n-1} \cdot \frac{AS}{\sqrt{n}}$$

Absolute Bias Upper Bound of Flow Rate Verifications Bias is estimated using an upper bound on the mean absolute value of the percent differences where n is the number of flow rate verifications being aggregated; t 0.95,n-1 is the 95th quantile of a t-distribution with n-1 degrees of freedom. The quantity AB is the mean of the absolute values of the di's and is calculated using equation 4 and AS is the standard deviation of the absolute values and is calculated using equation 5.

$$AB = \frac{1}{n} \cdot \sum_{i=1}^{n} |d_i|$$

Mean Absolute Bias Value of the Flow Rate Verifications. The quantity AB is the mean of the absolute values of the percent differences and will be calculated from equation 4 or using the AVERAGE function in an Excel spreadsheet.

$$d_i = \frac{Y_i - X_i}{X_i} \times 100$$

Standard Deviation of the Absolute Bias Value of the Flow Rate Verifications AS is the standard deviation of the absolute values of the percent differences, di's of the flow rate verification and will be calculated from Equation 5 or using the STDEV function in an Excel spreadsheet.
Semi Annual Flow Rate Audit Assessment- For each audit of flow rate with a standard calculate the percent difference between the samplers flow rate and that indicated by the standard, using equation 1 where Yi is the samplers flow rate and Xi is the flow rate from the audit instrument.

$$m = \frac{1}{k} \cdot \sum_{i=1}^{k} d_i$$

Semi Annual Flow Rate Audit Assessments-. To quantify flow rate audits annually at the site level and over 3 years, probability limits will be calculated from the flow rate audits percent difference di values using equations 6 and 7 where m is the mean over the time period being evaluated from equation 8 and S is the standard deviation of the percent differences as calculated in equation 9. Ninety-five percent of the individual percent differences (all checks) for the performance evaluations should be within this probability interval.

$$S = \sqrt{\frac{k \cdot \sum_{i=1}^{k} d_i^2 - \left(\sum_{i=1}^{k} d_i\right)^2}{k(k-1)}}$$

Semi-Annual Flow Rate Audits Standard deviation of the Percent Differences

Quarterly Calculations

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the data quality objectives for precision, we must ensure the entire measurement process is within statistical control (stable).

Accuracy or Total Error Checks

Accuracy is defined as the degree of agreement between an observed value (the value produced by our instruments) and an accepted reference value (a standard or "known" value that is accepted to be the "truth") and includes a combination of random error (imprecision) and systematic error (bias). In order to estimate accuracy, some external instrument must be compared against the field instruments. This external standard can be from another tribe, the EPA regional office, etc. but it must not have been calibrated with the same primary standard as the field equipment against which is to be compared.

Pollutant: PM10 - Filter based local conditions

Parameters compared can be flow

Various accuracy checks are implemented in this air monitoring program: periodic performance audits conducted by Environmental Programs Department and participation in the National Performance Audit Program (NPAP) performance audits. These evaluations are discussed in the following sections. The results from any of these intercomparisons are carefully noted and charted. Charts are kept of results of intercomparisons over time to determine if there are trends. Results may still be within allowable QC limits but show a gradual trend high or low that can be a signal of future problems. Results of intercomparisons are graphed and reviewed by the QA manager at least once a month.

Performance Evaluation

A performance evaluation on each PM10 analyzer will be conducted every six months by the Environmental Programs Department PM10 monitoring program using the tribe's independent flow rate standard. Air Resource Specialists, Tribal Air Monitoring Support, or Southern Ute Indian Tribe will perform our bi-annual performance evaluation. The limits for the relative percent difference between the standard’s flow rate and the field sampler's flow rate are shown in Table 14.1 (Critical Criteria). A performance evaluation for the meteorological station will also be conducted every six months for calibration and verification purposes to maintain proper quality control in providing accurate data.

Independent Audits

Tribes receiving federal funding for ambient air monitoring should participate in the federally implemented National Performance Audit Program (NPAP) and the Performance Evaluation Program (PEP). Information on both of these programs can be found on the AMTIC website. It is important to intercompare with some standard not calibrated against the same standard used to calibrate your equipment. NPAP audits, which are through-the-probe audits, conducted using an NPAP van that travels to the site or some central location, are conducted on 20% of the sites within a monitoring organization or at least one site a year. The National Performance Evaluation Program (NPEP) audits will be conducted by US EPA Region 8 personnel in accordance with all applicable EPA SOPs once per year.

The U.S.EPA Region 8 Office periodically conducts site performance audits and/or technical reviews for the air-monitoring program. These audits and/or reviews will be conducted when necessary and if resources are available. The audit and/or review results will be summarized and reported to the tribe when they are finalized by the U.S.EPA regional office.

Field Blanks

Field blanks provide an estimate of total measurement system contamination, or what happens to each filter by everything other than the actual sampling in the monitor. A new filter in its protective cassette is inserted into the sampler and immediately removed and placed back into its baggie and set inside the sampler box out of the way of the intake mechanism. The routine filter is then inserted into the sampler as usual. The field blank is kept in the sampler box during the period the sampler is on and pumping air through the routine filter. When the routine filter is retrieved, the field blank is also. The field blank is then packaged and shipped with the routine filter. In this way any contamination in the sampler, transport cooler, or baggies can be detected.

Approximately one in every ten routine filters should be a field blank. Field blanks may or may not be identified as field blanks to the analysis laboratory. Field blanks are identified as such in the field data sheet and the copy of the chain of custody sheet that is kept by the tribal office using the notation "FB".

XIII. INSTRUMENTATION-ELEMENT 15 (B6)

Table 15-1 QA/QC Checklist

Item	Frequency	Parameter	Action	Documentation
Inlet	Monthly	Inner Surface	Replace impactor well (including new impactor oil)	Document in log book
In-line filter	6 Months	Check for loading	Replace	Document in log book
Air Screens (under samplers rain hood)	6 months		Clean and dry	Reference checklists or SOPs
Clean filter holding area, internal and external	Monthly		Clean and dry	Reference checklists or SOPs
Motor Blower assembly for Manual and Mass Flow Controlled Systems	Every N hours of operation	See manual	Replace when necessary	Reference checklists of SOPs
O-rings	Check for damage each site visit	See manual		Reference checklists of SOPs
Motor Brushes	After 400 hours	See manual	Replace when necessary	Reference checklists of SOPs

XIV. INSTRUMENT CALIBRATION ELEMENT 16 (B7)

The MegaVol flow rate calibration is performed using a flow rate transfer standard, which mounts on top of the filter cassette. Flow rate transfer standards are typically top-loading Orifice Plates or electronic mass flow meters. One simple method of calibrating the sampler is to use the optional Toploading Orifice Plate. This unit is specifically designed for the Ecotech MegaVol samplers and each orifice plate has been calibrated against a certified reference standard. A manometer (water filled U-tube or digital) is connected to the orifice plate and gives a pressure drop across the orifice which is related to volumetric flow rate. 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 6-1 summarizes the calibration frequency and requirements of the equipment used in this program. (Verifications, on the other hand, are made to verify that the operations of the instrument are within specified limits. Verifications do NOT include any adjustment to the sampler).

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 Comparing the calibration standard and/or transfer standard against the routine samplers or sensors.

Standards for Pressure and Temperature

Temperature- and pressure-sensing hardware must be calibrated annually. It is also necessary to recalibrate temperature and pressure sensors for other reasons, such as radical changes in equipment performance, before a complete instrument calibration. The barometer will be compared against a Fortin barometer. The calibration of the standard thermometer used to compare against the sampler (that serves as the temperature transfer standard) should be conducted if the temperature sensor on the sampler fails a check, and the requirement for the calibration of the standard thermometer is that the standard thermometer agrees to the standard against which it is compared to less than ±2%. The calibration of the standard barometer used to compare against the sampler (that serves as the pressure transfer standard) should be conducted if the pressure sensor on the sampler fails a check, and the requirement for the calibration of the standard barometer is that the standard barometer agrees to the standard against which it is compared to less than ±10 mmHg.

XV. DATA MANAGEMENT-ELEMENT 19 (B9)

Transmittal-Element 19c (B10-3)

Data transmittal occurs whenever information is transferred from one person or location to another or copied, by hand or electronically, 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.

The Air Program Supervisor is assigned the task of making a random selection of at least five percent of the data during each quarter that has been transmitted from one form to another or one place to another and checking its accuracy. This check and the results will be documented in the records for data validation; notes made in the header of each file or in the top several lines include what information/sources were compared, results, name, and date.

Table 19-1 Data Storage and Retrieval

Description	Originator	Recipient	QAMeasures
Database Entry	Laptop Computer	Backup Modem	Check of 100% of all data (field data sheets, QC
Electronic Data Transfer	Data Acquisition System	Laptop Computer	Parity Checking, Transmission Protocols
Electronic Data Transfer	Laptop Computer	Technician	Transmission Protocols
Calibration and audit data	Technician	QA Officer	Checked by QA Coordinator at least every month
AQS data summaries	Technician	EPA Region 8	Periodically checked by Air Quality Program Supervisor or QA officer
Datalogger support software	Datalogger	Laptop Computer	Raw data, only transmission protocols apply

Storage

Raw data sheets are retained on file at the Environmental Programs Department for a minimum of three years, and are readily available for audits and data verification activities. After three years, hardcopy records and computer backup media are cataloged and boxed for storage. Data archival policies for the data are listed in following table. Security of data in the database is ensured by password protection.

Table 19-2 Data Storage

Data Type	Medium	Location	Retention Time	Final Disposition
Chain-of-custody forms	Hardcopy	Office	3 years	Recycled
Field Notebooks	Hardcopy	Site and archived in office when full	5 years	
Database	Electronic (on-line)	Tribal air office	5 years	

XVI. ASSESSMENTS AND RESPONSE ACTIONS-ELEMENT 20 (C1)

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessments are an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

XVII. REPORTS TO MANAGEMENT-ELEMENT 21 (C2)

Reports to Tribal Authorities. Element 21a (C2-1)

There are two types of routine reports made to the tribal authorities: an annual report and a quarterly report. (This does not include the routine reports that pertain to QA issues and are described later.)

The annual report describes the air quality monitoring that may be pertinent such as problems encountered, air quality problems reported by the community and comparison to air quality measured on those days, etc. Maps showing air quality during different seasons may be appropriate.

The quarterly report will provide updates on the same topics, and may cover administrative issues such as personnel, allocation of funds for purchase or repair of equipment, and possible site relocation.

Reports to EPA. Element 21b (C2-2)

Whenever there is a change in this list of monitoring sites in a reporting organization, the Environmental Programs Department's manager will report this change to the USEPA Region 8 Office and to AQS. When there are changes in location of monitors or the network design is reviewed and changed, a revised QAPP will be issued. Copies of the revisions will be included in the annual report to the EPA Region 8.

XVIII. DATA REVIEW, VERIFICATION AND VALIDATION-ELEMENT 22 (D1)

Data validation is a combination of checking that data processing operations have been carried out correctly and of monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once problems are identified, the data can be corrected or invalidated, and corrective actions can be taken. There are 3 main criteria sections for the validation requirements:

The critical requirements listed in table 14-1 Critical Criteria Table (section 14a) applies to all data. If any particular data point does not meet each and every criterion on the Critical Criteria Table, that point should be invalidated unless there is a compelling reason and justification for not doing so. Basically, the concentration or time period for which one or more of these criteria are not met is invalid until proven otherwise. The cause of not operating in the acceptable range for each of the violated criteria must be investigated and minimized to reduce the likelihood that additional data will be invalidated.

The operational requirements listed in table 14-2 Operational Criteria Table (section 14b) is important for maintaining and evaluating the quality of the data collection system. Violation of a criterion or a number of criteria may be cause for invalidation. The decision to invalidate or not should consider other quality control information that may indicate the data are acceptable. Therefore, the concentration or time period for which one or more of these criteria are not met is suspect unless other quality control information demonstrates otherwise. The reason for not meeting the criteria MUST be investigated, mitigated or justified, and always documented.

Systematic criteria listed in table 14-3 Systematic Data Table (section 14c) are criteria that are important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples. If these objectives are not met, this does not invalidate any of the data but it may impact the error rate associated with the attainment/non-attainment decision.

XIX. VALIDATION AND VERIFICATION METHODS-ELEMENT 23 (D2)

This section describes how the Environmental Programs Department verifies and validates data collection operations. Verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Verification usually consists of checking that the SOPs were followed and that QC limits were met. Validation is confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Validation consists of ''stepping back'' from the process and evaluating whether the data you are gathering are useful for your purpose. Earlier elements of this QAPP describe in detail how the activities in these data collection phases are implemented to meet the data quality objectives of the program. Review and approval of this QAPP by the personnel listed on the approval page provide initial agreement that the processes described in the QAPP, if implemented, will provide data of adequate quality. In order to verify and validate the phases of the data collection operation, the Environmental Programs Department uses qualitative assessments (e.g., technical systems audits, network reviews) to verify that the QAPP is being followed, and relies on the various quality control samples, inserted at various phases of the data collection operation, to validate that the data will meet the DQOs.

The ambient air data is used to evaluate the adequacy of the sampling design. By continuously reviewing the data and whether it is consistent with the objectives of the network the Environmental Programs Department can determine whether monitors should be relocated, new monitors or monitor types purchased, etc. This information is included in network review documentation. The use of QC checks throughout the measurement process helps validate the activities occurring at each phase. The review of QC data such as the precision data, the performance evaluation, and the equipment verification checks that were described earlier are used to validate these activities.

Validation of QC procedures requires 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.

XX. RECONCILIATION WITH USER REQUIREMENTS ELEMENT 24 (D3)

Element 24 is required to address how the program plans to evaluate the measurement goals and continuously improve. (This element comes from ISO 9001:2000, which states that "The organization shall continually improve the effectiveness of the quality management system …") The resulting measurement quality objectives (MQOs) are listed in tables 14.1, 14.2 and 14.3. This QAPP outlines the procedures that the Environmental Programs Department will follow to determine whether the monitors are producing data that comply with the DQOs as well as other factors that affect the usability of the data and what action are taken as a result of the assessment process.

The quality assurance reports are reviewed, and basic summary statistics are calculated, the data are plotted, and evaluated. Common sense is applied to how well the data conform to expectations. Strange data, missing values, and any deviations from standard operating procedures are reviewed. This is a qualitative review. The Environmental Programs Department will generate some summary statistics for each of its primary analyzers by quarter, and year, as well as all results to date. The summary statistics are number of samples, mean concentration, standard deviation, coefficient of variation, maximum concentration, and minimum concentration at each site, by year and quarter, and season if that provides useful information.

References

1. Assistant Secretary for Environment, S. a. (1991). *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance.* Washington, D.C.: U.S. Department of Energy.

2. Campbell Scientific. (2011). *Campbell Scientific.* Retrieved from www.campbellsci.com

3. David L. Naftz, A. J. (2010). *Assessment of potential migration of contaminants from the White Mesa Uranium Mill to the Ute Mountain Ute Reservation and surrounding areas, Southeastern Utah.*

4.Ecotech Environmental Monitoring (2009), Ecotech Environmental LLC., MegaVol 3000 Operations Manual, American Ecotech LLC 100 Elm Street, Factory D, Warren, RI 02885 USA

5.*Guidance on Implementing the Radionuclide NESHAP (1991),* U.S. Environmental Protection Agency Office of Radiation Programs.

6. Professionals, I. f. (2011). *Patent No. Turbo QAPP Software.* USA.

7. Register, N. A. (n.d.). Retrieved 2011, from Electronic Code of Federal Regulations: www.ecfr.gpoaccess.gov

8. Tisch Environmental. (n.d.). Tisch Environmental, Inc. In *Operations Manual, Tisch Environmental High Volume PM10.* Cleves, Ohio: Environmental Protection Agency.