QUALITY ASSURANCE PROJECT PLAN

Ambient Air Monitoring for Ozone (O3)

Using the Thermo 49i Monitor and the Teledyne T703U Calibrator

BISHOP PAIUTE TRIBE

ENVIRONMENTAL MANAGEMENT OFFICE

December 2022

For additional information, contact Emma Ruppell, Air Quality Specialist at 760 873 7845 or emma.ruppell@bishoppaiute.org

QAPP - CATEGORY

Category 1

QAPP - IDENTIFICATION AND APPROVAL. Element 1 (A1)

Brian Adkins, Bishop Paiute Tribe, Environmental Management Office, Environmental Director

Signature: _____ Date:_____

Emma Ruppell, Bishop Paiute Tribe, Air Quality Specialist

Signature: _____ Date:_____

EPA Region 9, Name: _____

Title: _____ Branch: _____

QAPP - TABLE OF CONTENTS. Element 2 (A2)

QAPP - DISTRIBUTION LIST. Element 3 (A3)

Paper or electronic 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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QAPP - PROJECT ORGANIZATION. Element 4 (A4)

Personnel. Element 4a (A4-1)

This agency incorporates quality assurance activities as an integral part of any program that gathers environmental data, from work in the field, from their own data analysis and reporting, and from any consulting and contractors that they may use.

The following sections list the responsibilities of each individual in the Bishop Paiute Tribe's Environmental Management Office involved in the Air Quality Program. The Tribal Administrator, who is above the Environmental Director in the organization, is the *Authorized Agent of the Principal* and signing party on all contracts entered into by the Tribe which are coordinated by Air Program staff. Likewise, the payer of the contract is the Chief Financial Officer, on behalf of the Bishop Paiute Tribal Council. An organizational chart is shown at the end of this section.

Environmental Director – Brian Adkins

The Environmental Director has overall responsibility for managing the Environmental Management Office's Air Quality Program. The Director does not have direct responsibility for instrument maintenance, data collection or data management, and is not responsible for day-to-day QA implementation. The Director is responsible for establishing QA policy and for resolving issues arising at the organizational level which may affect QA. Major QA-related responsibilities of the Environmental Manager include:

- Reviewing acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements) to determine the necessary QA requirements;
- Assuring that the Air Quality Program develops and maintains this QAPP and ensuring adherence to the document by staff, and outside contractors as appropriate;
- Maintaining regular communication with the field, and other technical staff;
- Ensuring that all personnel involved in this program have access to any training or QA information needed to be knowledgeable in QA requirements, protocols, and technology of that activity;
- Reviewing and approving this QAPP;
- Ensuring that this program is covered by appropriate QA planning documentation (e.g., QA project plans and data quality objectives);
- Ensuring that reviews, assessments and audits are scheduled and completed;
- Recommending required management-level corrective actions; and
- Serving as the program QA liaison with EPA regional QA Managers or QA Officers and the EPA regional Project Officer.

Emma Ruppell: Air Quality Specialist

The Air Quality Specialist is responsible for all phases of the project, including but not limited to:

- Developing and maintaining this QAPP;
- Developing QA documentation and providing answers to technical questions;
- Participating in training and certification activities;
- Writing and modifying standard operating procedures (SOPs);
- Verifying that all required QA activities are performed and that measurement quality standards are met as required in this QAPP;

- Following all manufacturer's specifications;
- Performing and documenting preventative maintenance;
- Documenting deviations from established procedures and methods;
- Reporting all problems and corrective actions to the supervisor;
- Assessing and reporting data quality;
- Preparing and delivering reports to the supervisor; and
- Data validation and reporting including flagging suspect data.

QA Manager (Contractor) – Scott Weaver

Scott Weaver was formerly staff of GBUAPCD for 18 years; his duties there were mainly performing data analysis. Mr. Weaver has been assisting the Air Program via contract since 2015, and has experience performing air monitoring activities. This ensured continuity by providing supplemental expert guidance, training, and technical assistance for the Air Quality Specialist. In 2021, Mr. Weaver's duties were changed when he committed to the role of the Program's QA Manager, and he no longer provides assistance with the monitors. A summary of his primary duties as QA Manager are:

- Perform Level 3 data review and analysis for select periods, including review of Level 1 and 2 validations, and review of QC records and audit reports, to establish qualification of the monitoring data in meeting criteria outlined in this Plan. In the event that a Level 2 reviewer was not available, Mr. Weaver will default to the Level 2 reviewer additionally.
- Report any problems identified during quarterly Level 3 data review and QA oversight review to the Environmental Director, more senior staff and EPA as necessary, and the Air Program.
- Advise on monitoring procedures, equipment, and regulatory specifications to ensure monitoring is conducted in accordance with this QAPP and included SOPs for Data Verifications and Management.

Dave Yoho: Auditor with T&B Systems

The auditor from T&B Systems conducts an annual instrument audit and reviews quality assurance, quality assessment, and quality control activities and ensures that ambient air quality data meet or exceed the data quality objectives of the Tribe. The auditor is responsible for certifying standards used in the field and generating audit reports.

T&B Systems conducts audits for a number of air districts and at times has performed audits for GBUAPCD. T&B is a technically sophisticated firm that conducted the upper air monitoring for the Owens Dry Lake on behalf of GBUAPCD, ozone study for Clark County, and PM10 study for Maricopa County. The decision was made to use an outside contractor because GBUAPCD does not have sufficient personnel to conduct additional audits. Audits performed by GBUAPCD were done under contract just like those performed by T&B Systems.

The Bishop Tribal Air Program regularly discusses and compares operational and QA related issues with GBUAPC, who operate the NCore ozone monitor in Owens Valley.

Level 2 Data Reviewers

Since 2020, this role has been assumed by Cindy Duriscoe with the Big Pine Paiute Tribe. In the event that a Level 2 reviewer was not available, Mr. Weaver will default to the Level 2 reviewer additionally. Data review is primarily conducted in the QREST software (Quality Review & Exchange System for Tribes, described in more detail below), or via direct analysis of raw data, or via data in the Vista Data Vision software (also described below). Depending on factors such as staff availability, Level 2 data reviewers

could potentially include, for example, other neighboring tribal Air Quality staff such as Lone Pine Paiute-Shoshone Air Quality Specialist, the Bishop Tribe Water Quality Specialist, the Owens Valley Indian Water Commission Environmental Specialist, and ITEP staff.

Since the prior revision of this Plan, Air Quality staff from other Owens Valley Tribes and Bishop Tribe have been able to collectively provide each other with assistance, which serves as independent oversight when provided, though the lead responsibility of QA oversight is as otherwise discussed.

Great Basin Unified Air Pollution Control District (GBUAPCD) has historically made effort to be available for technical assistance or contract assistance to the Tribe; in particular, Chris Lanane, Air Monitoring Specialist, and Guy Davis. In 2016, the Tribe requested GBUAPCD to assess their availability and further define their role in Bishop Tribe's QA activities; no commitment was made at this time. Since then, GBUAPCD staff have been available to answer specific questions as needs arise.

QAPP - PROBLEM DEFINITION/BACKGROUND. Element 5 (A5)

Problem definition. Element 5a (A5-1)

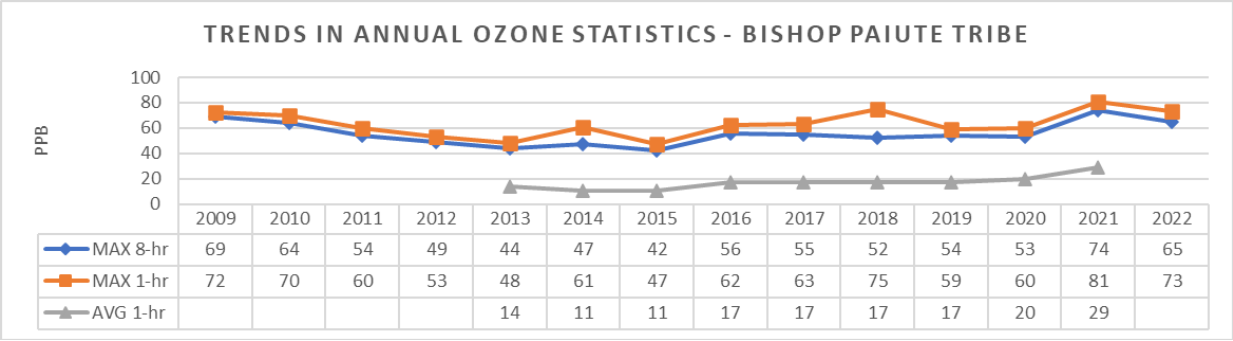
The CAA and its amendments provide the framework for all pertinent organizations to protect air quality. This framework provides for the monitoring of criteria pollutants including ozone by the Bishop Tribe's Environmental Management Office (EMO), as part of an integrated, Reservation-wide environmental protection effort. The EMO's sampling network functions for informational purposes, based on the Tribal air quality standards (adopted in April 2006), and to meet the following additional objectives:

- Determine the highest concentrations to occur in the area covered by the network (the Bishop Paiute Reservation)
- Differentiate between general background concentration levels including biogenic sources and human-caused levels (which may involve using data generated outside the project)
- Improve the understanding of the extent of regional pollutant transport into the Owens Valley
- Comparisons to the Tribal Air quality Standards (adopted in 2006) will be used for informational purposes only including potential health-related evaluation.

Ozone monitoring was initiated in response to increasingly stringent ozone standards and in the context of ozone exceedances in the town of Mammoth Lakes to the North and in Death Valley National Park to the South. The concern is transport from the central valley (San Joaquin Air Quality District). Formal recommendations on area designation status were made based on Tribal ozone data. Currently, there are new concerns over ozone generated from wildfires, which affect the Owens Valley via transport up the 395 corridor or via mountain passes connecting the West and East Sierras. Ozone data from the Tribe's monitor have been used in area wide designation studies with GBUAPCD, and are shared with Forestry managers in evaluating the effects of controlled burns and managed wildfires.

Every year, the Tribe submits to EPA R9 Grants and Program Integration Office (Air and Radiation Division) an annual summary of statistics of the monitoring data. Recorded maximum concentrations for recent years are summarized in Figure 1 below. The highest recorded concentrations occurred in August 2021.

Figure 1. Annual Maximum 8-Hour Concentrations, ppb



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
MAX 8-hr	69	64	54	49	44	47	42	56	55	52	54	53	74	65
MAX 1-hr	72	70	60	53	48	61	47	62	63	75	59	60	81	73
AVG 1-hr					14	11	11	17	17	17	17	20	29	

The ambient air monitoring station is located in the Bishop Paiute Tribe's Environmental Management Office Building, inside the Air Lab, a small, temperature-controlled room that includes the ozone analyzer, the calibrator and an industrial design uninterruptable power supply. The instruments are mounted in together in rack.

Problem background. Element 5b (A5-1)
The location(s) of the analyzers and the rationale for these location(s) can be found in Section 10. This QAPP describes project methods, refers to EPA-established data quality objectives, and defines data quality assurance and control methods for ozone monitoring by the Environmental Management Office. 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 ozone transport from the central valley of California (San Joaquin Air District). This concern emerged in response to ozone exceedances in Mammoth Lakes, to the North, and Death Valley to the South. In the face of increasingly stringent ozone standards and in the absence of any other ozone monitoring in the region, the Tribe felt that accurate measurement was important to protect the health and safety of its people.

QAPP - PROJECT DESCRIPTION. Element 6 (A6)

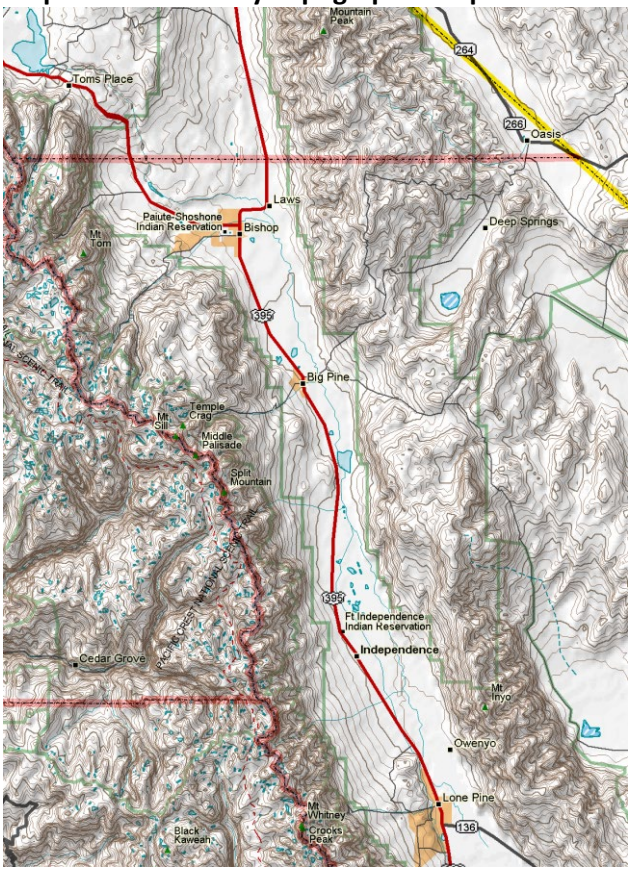
Summary. Element 6a (A6-1)
The measurement goal of this O3 Ambient Air Quality Monitoring Program is to estimate the concentration, in units of parts per billion (ppb), of O3 in ambient air. The following sections describe the measurements required for the routine field activities for the network.

Project information. Element 6b (A6-2)
The performance requirements of the analyzer have been specified in Appendix D of 40 CFR Part 50. The analyzer used in this program is designated as an EPA automated equivalence method in accordance with 40 CFR Part 53. The method we are using is designated by EPA as method designation number EQOA-0880-047.

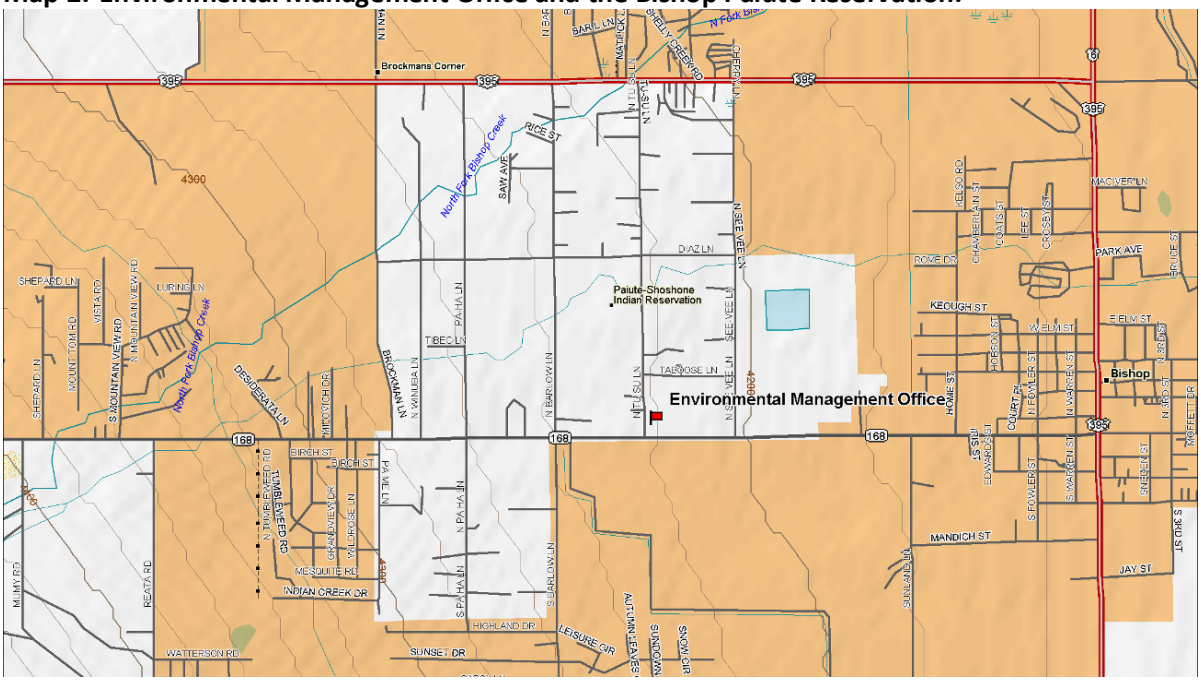
Project schedule. Element 6c (A6-3)
Measurements are obtained for hourly averages, which can be reported from AQS in 24-hour daily averages, 8-hour averages. The monitor was installed in 2007, and an API 703E calibrator was added in 2008. In 2022, the 703E model was replaced with a T703U (ultra-low) model from Teledyne API. Calibrations are automated using the calibrator internal scheduler, or can also be initiated via control inputs and running the calibrator in slave mode to an external source (a Sutron XLite data logger). Concentration data polling to the DAS in use by the Tribe is automated.

Project location. Element 6d (A6-4)
The air monitoring equipment is located at the Environmental Management Office at 50 Tu Su Lane, on the Bishop Paiute Reservation (N37°22', W118°25' at an elevation of 4,226 ft.), shown in Maps 1 and 2 and in the photographs below. As shown in Map 1, the Bishop Paiute Reservation is located in the Owens Valley in eastern California, near the Nevada border. The reservation itself comprises 875 contiguous acres and is flanked by the City of Bishop to the East. It is surrounded by private lands and by lands owned by the Los Angeles Department of Water and Power. Approximately 1,350 people live on the Reservation. Map 2 shows the location of the Environmental Management Office on the Bishop Paiute Reservation. Access to the sample inlet is via external stairs to the roof. Photos 1-8 show views of the sample inlet towards the 4 cardinal and 4 ordinal directions. *Note:* Photos may include other monitoring equipment in the view; not all aspects can be photographed from the rooftop.

Map 1. Owens Valley Topographic Map



Map 2. Environmental Management Office and the Bishop Paiute Reservation.



Photographs 1-8. Clockwise: North, Northeast, East, Southeast, South, Southwest, West, Northwest Rooftop Views, Ozone Air Monitoring Sample Inlet Location.

QAPP - QUALITY OBJECTIVES AND CRITERIA FOR MEASURING DATA. Element 7 (A7)

DATA QUALITY OBJECTIVES

Stating the problem. Element 7a (A7-1)
In recent years ozone exceedances have been recorded in the town of Mammoth Lakes, 45 miles to the North and in Death Valley 80 miles to the Southeast of the Bishop Reservation. Currently there is no equivalent ambient ozone monitoring in the nearby town of Bishop, the largest population center in Inyo County where the Reservation is located. GBUAPCD operates an NCore station in Owens Valley (in Inyo County); this system monitors for background levels and is deployable to other locations. In light of increasingly stringent standards, concerns about transport from the Central Valley, and health concerns, the Tribe felt that initiating ozone monitoring was an increasingly important aspect of its air monitoring program.

Identifying the decision. Element 7b (A7-2)
In 2006, the Bishop Tribal Council adopted air quality standards for four criteria pollutants, including standards for ozone. These standards largely mirror those that were current for the state of California, with some minor simplifications that make them slightly more stringent. The Tribal 8-hour standard for ozone is 0.07 parts per million and the Tribal 1-hour standard is 0.09 parts per million. These values are not to be exceeded more than once per year.

The goals of this air monitoring effort include comparing measured values to the Tribal standard and establishing a baseline so that changes in air quality can be tracked. If exceedances of the Tribal standard are observed, then analyses will be undertaken to determine the source and cause of the exceedance.

Identifying the inputs to the decision. Element 7b (A7-3)
The type of data needed is defined by the intended use of the data. In this case, the type of data needed is defined by the Tribe's 2006 air quality standards. There are two ozone standards: one applies to the highest values of 8-hour periods, and the second applies to a 1-hour average.

The process used to attain the 8-hour standard of 0.070 ppm (70 ppb): is detailed below in section 19: **Transformation and reduction**. Element 19b (B10-2) It involves calculating values for every rolling 8-hour period in the day.

The one-hour average is met when the expected number of days per calendar year with a maximum hourly average concentration above 0.09 ppm is equal to or less than 1. In general, the average number of exceedances per calendar year must be less than or equal to 1.

Defining the boundaries of the project. Element 7d (A7-4)
This project will measure ozone in order to determine whether the Tribal standard is met. Measurement will continue to determine any changes in air quality over time. The spatial boundary is the Bishop Paiute Reservation, which is 875 contiguous acres, which form a rough rectangle a little over 1-mile square.

Deciding on a decision rule. Element 7e (A7-5)
If it is determined that the ozone levels exceed the Tribal standards, the Air Quality Specialist will initiate an investigation to determine the source and cause. This investigation will include back trajectories, wind roses, pollutant roses, and examination of data from relevant monitoring sites. It will also include consultation with staff at GBUAPCD.

Specifying tolerable limits on decision error. Element 7f (A7-6)
The Tribe will follow the Data Quality Objectives (DQO) developed by the EPA for a determination of whether or not a particular location meets the national ambient air quality standards, but our comparison will be to the Tribal standards described earlier.

EPA decided that there should be a 5% (or less) chance of being wrong about whether a site meets or does not meet the standard. Errors may be due to measurement bias, imprecision, or incomplete data. The general goal is to keep the rate of these decision errors below 5%. In order to do this, EPA looked at all the data from the past few years in terms of bias and imprecision, and calculated that if each site keeps bias and precision both under 7%, this overall goal of limiting the decision error rate to 5% will be met. In this case, the DQO is a decision error rate of 5%, and this was translated by EPA into the measurement quality objective (MQO) for each individual site of 7%.

The Tribe will follow US EPA 40 CFR 58 Appendix A, 2.3.1.2, in selecting an acceptable measurement uncertainty for precision as an upper 90 percent confidence limit for the coefficient variation (CV) of 7 % and for bias as an upper 95 percent confidence limit for the absolute bias of 7%.

Optimizing the design. Element 7g (A7-7)
The design has been optimized to fit the budget and the needs of the Tribe. Priority has been placed on the objectives presented in element 6, and using a method that meets the requirements of measurements to determine compliance with the Tribe's air quality standard. If further information is gathered, or if the situation changes then the plan will be changed and this QAPP will be revised and reissued for review and approval.

DATA QUALITY INDICATORS

Precision. Element 7h (A7-8)
Precision is a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, or how well side-by-side measurements of the same thing agree with each other. It is important that the measurements be as similar as possible, using the same equipment or equipment as similar as possible. Precision represents the random component of uncertainty. Precision is estimated by various statistical techniques using variability in the instrument's response to known concentrations, as described in element 14.

For Ozone (O3), this refers to testing the analyzer at with steady, known concentrations across the instrument’s range. Span/zero tests and 3-point spans are run biweekly, and 5-point calibrations are run every 6 months. An outside audit is conducted annually by T&B Systems, as described in Element 4

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. In this program,

automated span/zero checks with a known concentration done every 24-hours and 3-point biweekly spans will be the major estimate of bias on an ongoing basis. Annual external audits will provide another estimate of bias. Only the results of audits made using a standard that is not calibrated against the same primary standard that is used to calibrate our field instrument will be used to estimate bias for purposes of reporting to EPA's AQS as bias. All our estimates of bias will be used internally.

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 inhaled by Reservation residents, 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 instrument.

Detection Limits. Element 7k (A7-11)
A detection limit is defined as the lowest value that a procedure can reliably discern. In other words, that level below which the instrument cannot discriminate from zero. The Thermo 49i manual lists the lower detect limit as 1 ppb. The instrument has a custom range setting of 50 to 1,000 parts per billion that meets the EPA designation requirements listed in 40 CFR 53 and 58.

Completeness. Element 7l (A7-12)
Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount 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 examples of 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. The organizations include the Clark County, Nevada Air District, local GBUAPCD, The Pala Band of Mission Indians, and the Southern Ute Air Program.

Accuracy. Element 7n (A7-14)
Accuracy is a term used to indicate closeness to truth and includes a combination of precision and bias uncertainty components. This term has been used throughout the CFR. Although the conventions of the NIST and, more recently, of EPA (ref. NIST Report 1297 and EPA G-9) advise against using the term accuracy because it is confusing, many guidance documents and the EPA's AQS database still use the term accuracy. Accuracy should be used when a standard is used to compare against the equipment routinely used by the tribe. This will 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 using a different

standard than that used to calibrate the site operator's field equipment, and by a qualified operator other than the routine site operator. Because of this, the differences in results between the performance audit and the site operator's field instrument's result, as an average over all the times such performance evaluations have been conducted, should represent our best estimate of the inaccuracies of our measurement system.

QAPP - SPECIAL TRAINING / CERTIFICATION. Element 8 (A8)

Workshops and courses hosted by the Institute for Tribal Environmental Professionals (ITEP), the California Air Resources Board (CARB) and informal training with staff from GBUAPCD are available to project personnel. All personnel participate in this training. Records on personnel qualifications and training are maintained in the Environmental Management Office as a part of grant records and are accessible for review during audit activities. In addition, technical support is available from Thermo (formerly R&P), the equipment manufacturer and is used in to evaluate potential equipment problems.

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 Management Office. All personnel directly involved with this project will have adequate time to read this document and relevant references (16 hours minimum). New personnel will work under the guidance of experienced personnel for a minimum of one month. If experienced Tribal staff are not available, mentoring is requested from GBUAPCD.

Certificates are available at the Air Quality Specialist's desk. Examples of recent training attended by the Air Quality Specialist include EPA's APTI SI-470 course, gaseous monitoring and ground-level ozone seminars at the 2016 National Ambient Air Monitoring Conference including a day-long QA 101 session, hands-on ozone monitoring specific workshops at ITEP Fundamentals of Monitoring in 2016, ozone-specific presentations at the Western Regional Air Partnership (WRAP) in 2016, and on-site monitor overview at GBUAPCD's NCore station at the White Mountain Research Center in Owens Valley in 2016, and attending the National Tribal Forums for Air Quality since 2016.

Dr. Richards, the former Air Quality Specialist, was trained as an auditor by GBUAPCD, by observing their auditor for a year prior to conducting audits. Past examples attended by the former Air Quality Specialist include a Gaseous Pollutant Monitoring ITEP class in 2009, specialized training at the (Tribal Air Monitoring Support) TAMS Center and Clark County Air District to discuss local ozone transport studies, The former Air Quality Specialist also researched multiple ozone measurement protocols assessments nationwide and tested Ogawa passive samplers, and researched ozone effects on vegetation in Sierra Nevada Parks, spatial distribution of tropospheric ozone in CA National Parks, personal exposure studies, and gave a presentation for various audiences explaining high ozone levels in Owens Valley in 2008 with technical assistance provided by GBUAPCD and T&B Systems.

QAPP - DOCUMENTS AND RECORDS. Element 9 (A9)

It is critical that management understand that properly documenting the project's activities takes time. The Environmental Management Office air monitoring network was established to determine baseline ozone levels, evaluate trends over time, and document any transport issues with the goal of protecting the health of the resident of the Bishop Paiute Reservation. The air monitoring program is committed to fully document all activities relating to data collection, analysis, validation, and reporting.
Each set of records that is often used is listed on a master file location/accessibility map showing where these files are, and by whom they are accessible. This file map is readily available in electronic form to allow easy revisions and location of the files.

Files are organized in a way that allows each data point to be tracked from the beginning of the measurement through validation, analysis, and reporting. All files are stored electronically. Official data, collected via the data acquisition system (DAS) explained further in Element 10, are maintained on the QREST server managed through Northern Arizona University. Analysis files are maintained on the Air Quality Specialist's computer and backed up to the Environmental Management Office server.

Analysis files are maintained on a yearly basis and folders are grouped accordingly.

The tables below describe the system for documentation and records. The categories listed in parentheses and in italics, in the first column of the table are taken from the Quality Assurance (QA) Handbook for Air Pollution Measurement Systems, Volume II, 2013, Appendix H.

Table 9-1. Documentation and Records for Project Planning. Element 9a (A9-1)

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Planning / Administrative (establishing air program): Structuring department	Draft and final copies of grant application, and department files and mission statement. Management structure.	Mission statement on file with Environmental Manager and posted in the Environmental Management Office. Annual grant applications and files available at the Air Quality Specialist's desk.	Air Quality Specialist	Grant files are established annually and retained for five years, then moved to storage.	
Budgeting	Budget	Funds and expenditure records	The Bishop Tribe's Fiscal Office	The Air Quality Specialist requests a monthly report of expenditures from the Grants Specialist in the Tribe's Fiscal Office	Mid-year budget is presented to the Environmental Director
Staffing *(1a)*	Hiring and personnel records	The Tribe's Human Resources Department	Human Resource Generalist	As needed	

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Training *(1f)*	Training certificates	Air Quality Specialist's desk	Air Quality Specialist	Information updated as training is completed and in Quarterly reports to EPA	
Contracting for audits and to support automated data transfers *(1i)*	Copies of contracts with subcontractors and equipment vendors	Support contracts	The Tribe's Fiscal Office and the Air Quality Program	When contracts are established, renewed, or changed	
Planning – objectives for measurements: Quality Objectives (MQOs) documented (precision, bias, completeness)	MQOs written or adapted from QA Handbook	QAPP file & drafts	The Air Quality Specialist	During planning, and revised annually as resources allow.	
Data analysis procedures drafted *(4)*	In reports using specific analytic procedures and in QAPP	Air Quality Specialist's desk	Air Quality Specialist	as needed; see following tables	
Planning – siting: Siting decisions: rationale for siting at that location, restrictions if any, and type of site *(2a, 2div)*	Site maps and photos	Network description and review file; in QAPP	Air Quality Specialist	Annually and when analyzers are relocated	
Decide on site IDs *(2a, 2div)*	IDs for sites and characteristics	Site maps/photos	Air Quality Specialist	Photos and maps are reviewed annually for significant changes	
Site Routes and Scheduling Planned	Site route and schedule assignment posted	Site route / schedule / assignments	Air Quality Specialist	Updated as assignments / routes change	
Planning—instrumentation: Standards ordered / purchased *(2dii)*	Maintenance agreement with instrument vendors, calibration labs / vendors, standards vendors	File for each standard, including service agreement	Air Quality Specialist	As updated copies are replaced, all standards are retained on file	
Instruments ordered / purchased DAS system chosen / purchased *(2dii)*	Instrument specifications and manual, purchasing documents	Instrument and DAS manuals, training materials, SOPs	Air Quality Specialist	As updated copies are replaced, all standards are retained on file	

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Data transfer logs or forms designed *(* D.1)*	Maintenance logs and audits Manual validation notes Operator log notes	3-ring binders for each site included maintenance forms / reports, completed verification forms, audit reports. On-line operator's log contains additional routine maintenance notes Validation notes, Instrument logbooks	Air Quality Specialist	Ongoing after any maintenance, audit or manual validation process.	

Table 9-2. Documentation and Records for Project Operations. Element 9b (A9-2)

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Initial readiness review (internal audit) report received	Copy of readiness review report/checklist	Audit file complete	Air Quality Specialist	Complete	
Operations--Assessments and Audits: Annual external audit with standards not calibrated using the same primary standard as ours EPA Regional Technical Systems Audit or equivalent *(1i)*	Audit report	Audit file	Reviewed by Air Quality Specialist	When report is received	
Operations / Data gathered/received: Data transfer from analyzer *(4a, 4d)*	QREST Server and Sutron software logs	Viewed on QREST and Tribe's own websites, files with downloaded data; logger downloads	Automated	Every 15 minutes by automated polling of DAS	
Operations / Maintenance Biweekly site visit *(2di, 3a)*	Check instruments as specified in QAPP and instrument manual	, Maintenance checklists filed in 3-ring binder for instrument, instrument logbook	Air Quality specialist	Daily at the beginning of the program, every 2 weeks when system is stable	
Operations / Shipping / Receiving *(2dii)*	Logs for shipping / receiving set up	Shipping / receiving file with paperwork and comments, grant binder for appropriate year	Air Quality Specialist	As items come in	
Operations / Site QC checks as specified in QAPP and instrument manuals *(2di, 3a)*	QC check sheet with parameters and sensors as specified in QAPP	Site log, field forms	Air Quality Specialist	The results of QC checks are reviewed as covered in SOPs.	

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Operation / Calibrations *(2diii)*	Information on calibration results/status Notes	Monthly field form, instrument logbook, electronic operator log, and raw data records	Air Quality Specialist	Semi-annually or as needed, (see Section 14)	

Table 9-3. Documentation and Records for Data Management. Element 9c (A9-3)

Action/Event Recorded (what)	Information (where)	Recorded in	By Whom	How Often (when)	Comments
Checks to make sure that maintenance is being conducted according to the posted schedule (2div, 2dv)	Schedule of daily, biweekly, monthly, and annual maintenance and service	QA Checklist, Operator calendar, QAPP, field forms	Air Quality Specialist	Quarterly review of QA Checklist	
Data Management / Data analysis: Calculations of relevant statistics (4d)	QC check results for SPZ and SPN checks are in raw data records, pre-validated QREST data	QC check results entered into DASC tools; database, monthly field form	Air Quality Specialist	Biweekly (checks), Quarterly, Annually	
Data Management - Housekeeping Move electronic files Electronic files archived (4a)	Documented using standard nomenclature for file names including date	Raw data folders; QREST database; downloaded QREST files	Air Quality Specialist	Data from monitor are automatically transferred to the logger and from there to QREST server	
Data Management – Reporting to Tribe (4e)	Results Summary of air quality data QC information	Monthly reports to the Tribal Environmental Board and to the Tribal Council Data available in near real-time on the Tribe's own website and on QREST	Air Quality Specialist	Ongoing and monthly	
Data Management – Reporting to EPA (4f)	Quarterly and in annual grant application	Quarterly and annual report	Air Quality Specialist	Quarterly	
Data Management – Reporting to AQS (4f)	As required by AQS and CAA 103 grant	AQS (after manual validation)	Air Quality Specialist	Quarterly	

Data transfer guidelines. Element 9d (A9-4)

1. Concentration data are downloaded biweekly for report creation efforts or as needed for diagnostics.
2. Names – .txt and .csv files are saved in location for original files; copied into Excel spreadsheets with name indicating the date/year.
3. Housekeeping - data polling of the logger by the DAS used by the Tribe is automated. Intervals – 5-minute averages are constructed by the data logger; which is transferred to the QREST server.

4. Downloading Data: The information is available on the QREST website every hour for the prior hour in local time.
5. Set criteria for data review:
    a. Incomplete, missing or out of range data can be configured in QREST for automatic flagging.
    b. During manual validation, the Air Quality Specialist completes a detailed review of all data prior to AQS submission. This review is based on:
        i. QA Handbook Vol II data validation tables
        ii. Instrument manuals, logbooks, and automated QC check results, calendars, and other internal systemic records, schedules, and datasets, visual observations of the monitoring system and equipment inspection
        iii. Common sense and experience
        iv. QC checks that within satisfactory range and bracket the time period of the data, which are listed in the program QAPP (sections 14 and 7)
        v. Specific requirements, such as other data being available for that time period

Data review documentation guidelines. Element 9e (A9-5)

1. Some portion of the information is collected by hand, including collecting and checking site logs and maintenance sheets. In order to write the data review standard operating procedure (SOP), at least one initial data review exercise is conducted with all logs, QC sheets, hard copies of data and validation tables, audit reports. All of the steps of data review and flagging are documented in an SOP, which is also edited upon any changes in procedures discovered to be beneficial.
2. As much automation as possible of the data review process is implemented to reduce manual error and stay on schedule. The primary tool is now the EPA DASC tool (formerly was the combined Sutron DAS and TrEx server/website), combined with special analyses that may be conducted using Excel or other statistical software.
3. Data validation produces a set of validation notes available on-line to authorized personnel.

Data file structure and naming conventions. Element 9f (A9-6)

This addresses data files only and is one component of the overall filing system that must be set up for an environmental data gathering operation. The main repository of data is on the QREST server, with data available in near-real time on the Tribe's own website.

Raw data files for diagnostics are maintained at the Air Quality Specialist's secured computers and frequently backed up to an internal server which is backed up daily. Files are named by pollutant and by date. Special analyses are given descriptive names. Calculations are retained as formulas within Excel spreadsheets and are self-documenting.

Data are manually validated using the QREST software prior to AQS submission. AQS-formatted files are named by pollutant, month and year, then transferred to CDX and to AQS.

QAPP - SAMPLING DESIGN. Element 10 (B1)

Probe Location. Element 10a (B1-1)
This section describes the rationale for the locations of the measurements, the frequency of sampling, the types of monitors used at each site, and the location and frequency of the performance evaluations. The network design components comply with the recommendations in 40 CFR Part 58 Appendix D. The ozone monitor inlet probe should be as close as possible to the breathing zone. The sample inlet probe height must be 2 to 15 meters above ground level. The probe must also be located more than one meter vertically or horizontally away from any supporting structure. There must be at least 10 m from the probe to the dripline of any tree.

In our case, the monitor inlet is located above the roof of the Environmental Management Office, and is held away from the building and other obstacles by having the Teflon tubing fed through a PVC "candy cane." The probe is approximately 5 meters above ground level.

The location of the probe meets the criterion of distance from obstacles and buildings such that the distance between the obstacles and the inlet probe is at least twice the height that the obstacle protrudes above the probe. The probe is not considered obstructed because an imaginary line extended 30 degrees up from the horizontal and rotated 360 degrees does not intersect any obstruction within 30 meters. Airflow is unrestricted in an arc of at least 270 degrees around the inlet probe, and the predominant wind direction for the season of greatest pollutant concentration potential is included in the 270 degrees arc. The probe is over 1 meter vertically or horizontally away from any supporting structure, walls, parapets, penthouses, etc., and away from dusty or dirty areas.

Analyzer Location. Element 10b (B1-2)
Spacing from Roads - It is important in the probe siting process to minimize destructive interference from sources of nitric oxide (NO), including parking lots, driveways, and traffic alleys since NO readily reacts with ozone. The nearest roads are Tu Su Lane and West Line Street, both are over 70 meters away and neither has over 10,000 vehicles per day.

Number of sites. Element 10c (B1-3)
The procedure for siting the monitors to achieve the basic objectives is based on judgmental sampling, as is the case for most ambient air monitoring networks. Judgmental sampling uses data from existing monitoring networks, knowledge of source emissions, population distribution, and weather information to select the best monitor locations. Judgmental sampling is easier to implement and makes sense in most air monitoring situations. Judgmental sampling is used here instead of random sampling, where samples are placed in randomly chosen locations throughout the area of concern (Bishop Paiute Reservation), or systematic sampling, where samples are evenly spaced by area.

Rationale for the Design. Element 10d (B1-4)
We have elected to use a single monitor for the Reservation because it is comprised of 875 contiguous acres. The ozone monitor is located inside the Bishop Tribe's Environmental Management Office building. The site also includes our two PM monitors and our meteorological monitoring station. The location meets EPA siting criteria with regard to distances from obstructions and from roads. It has the added advantage of being immediately adjacent to the Toiyabe Indian Health Project's clinic and dialysis center. So that air quality is being monitored near these two very sensitive populations.

References
The network design complies with the regulations in 40 CFR Part 58 Section 58.13, Appendix A, and Appendix D.

Table 10-1. Site / Monitor Design Summary. Element 10e (B1-5)

Site	Monitor	Method Name	Monitor Objectives	Sampling Frequency	Scale
Bishop Paiute Tribe, Environmental Management Office (AQS Tribal Site 549 or 06-27-1023)	Ozone (O3)	Thermo Fisher 49i	a. To characterize concentrations for health and welfare (attainment of Tribal standards) b. To assess and characterize transport of pollutants.	Monitoring is conducted 24-hours a day year-round	Neighborhood

QC Monitors. Element 10f (B1-6)
Not applicable

Table 10-2. Project schedule. Element 10f (B1-7)

Activity	Due Date	Comments
Order monitor	June 2007	Ordered from Thermo Fisher.
Receive monitors	August 2007	
Install monitor at site	November 2007	Insufficient funds for calibrator. Monitor only installed for preliminary testing. Calibrator purchased in November 2008 to complete system.
Begin routine sampling	October 2011	Following submission of QAPP
Transition to QREST & DASC tool	2020	TREX DAS replaced with QREST; begin evaluations of QC check results with DASC tools.
New calibrator installed	July - Oct 2022	Begin calibrating at low level concentrations
Report validated data to AIRS-AQS	Due within 90 days after end of quarterly reporting period.	
Performance Evaluations	Informal evaluations are ongoing; formal evaluations occur annually as performed by third party firm T&B Systems.	
Review internal and external QA reports	Ongoing	Needed to determine which, if any, monitors fail QC limits.
Primary network review	Annually	Evaluate reasonableness of siting, frequency, and number of monitors.
Evaluate location of monitors	Annually	At time of network review.
QA Manager review	Quarterly	Review of status/progression of scheduled maintenance and service

QAPP - SAMPLING METHODS. ELEMENT 11 (B2)

EPA automated equivalent methods monitors will be used for collection of O3 data for comparison to the Tribal standards. These analyzers are automatic monitors that have met EPA equivalency requirements for measuring O3. The analyzer will be installed with adherence to procedures, guidance, and requirements detailed in 40 CFR Parts 50, 53 and 58; O3 Analysis, EPA QA Handbook Volume II: Part 1, the analyzer manufacturer's operation manual, and the SOPs attached to this QAPP.

The O3 analyzer will be stationed in the Bishop Tribe's Air Lab, located in the Environmental Management Office, a climate-controlled structure.

The 49i gas analyzer's output is transmitted to the Sutron XLite data logger. The data logger receives the analog output from the analyzer and converts the voltage to ppb. The continuous voltage can be inspected from a terminal screen in Sutron's XTerm program, the visual interface of to the DAS. Data acquisition is every 2 seconds, after which the voltage is converted to ppb and 5-minute averages are calculated. The DAS retains several days of 5-minute averages. At 15-minute intervals, the Sutron software system polls the data logger and transfers the information to the EPA-funded QREST monitoring system, coordinated via Northern Arizona University. Data are available on-line at the QREST website and at the Tribe's own air quality website approximately 15-minutes after each hour.

QAPP - SAMPLE HANDLING ELEMENT 12 (B3)

Chain of Custody. Element 12a (B3-1)
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. To minimize transcription errors, all data transfers are automated. Any changes in the data are documented in the validation notes and DAS operator logs which are detailed in logs associated with the manual validation process prior to AQS submission.

Data Transfer. Element 12b (B3-2)
This section describes how the data are transferred from the monitor to a storage location (database or files). Data transfer to the QREST database is automated. 5-minute averages are collected every 15 minutes from the DAS.

QAPP - ANALYTICAL METHODS. Element 13 (B4)

Method Description. Element 13a (B4-1)
This section includes a brief description of the analytical methods to be used, the identification of any performance criteria, and the description of corrective actions when problems arise.

The monitoring project conforms to EPA method EQOA-0880-047 (method code 047).

The O3 analyzer is in a climate-controlled area in the Tribe's Air Lab, located in the Environmental Management Office. The temperature is kept between 20 and 30°C at all times using a set-back thermostat that integrates heating and air conditioning. The Air Lab is maintained in such a way as to minimize dust contamination and external vibrations from the equipment.

The Thermo Electron Model 49i UV Photometric Ambient O3 Analyzer is operated on a measurement range of 0-0.5 ppm with a 10 second averaging time and the following options: 49-001 Teflon Particulate Filter; 49-002 19 Inch Rack Mount; 49-103 Internal Ozone Generator. Calibrations and zero-span checks are performed with a Teledyne calibrator model 703U; I2C Bus.

Laboratory requirements. Element 13b (B4-2)
Not applicable

QAPP - QUALITY CONTROL REQUIREMENTS. Element 14 (B5)

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. 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 as per the QA Handbook Vol II 2017, Appendix D and are shown in the tables 14-1, 14-2 and 14-3, or are specific to the current programming of the DAS where noted.

Table 14-1. Critical Criteria. Element 14a (B5-1)

Requirement	Frequency	Acceptance Criteria	Information/Action	Corrective Action
Monitor	NA	Meets FRM/FEM designation requirements	Monitor meets requirements	Upgrade systems
Span/Zero check	Biweekly	<± 7.1% span drift <± 3.1 ppb (24 hr) zero drift, <± 5.1 ppb (>24 hr, 14 day)	QAHB Vol II Appx D p 5	Data rejected if zero fails.
1 point QC check)	Biweekly	<± 7.1% (percent difference) or <± 1.5 ppb difference whichever is greater	QAHB Vol II Appx D p 5	5-point calibration if necessary.

Table 14-2. Operational Criteria. Element 14b (B5-2)

Requirement	Frequency	Acceptance Criteria	Information/Action	Corrective Action
Shelter Temperature, Temperature range	Daily (hourly values)	20 to 30 ºC (Hourly average)		
Shelter Temperature, Temperature control	Daily (hourly values)	<±2.1 ºC standard deviation over 24 hours	The thermometer in the shelter will be checked twice a year against a standard, and not be more than 2 deg. C from the standard	Adjust thermostat offset appropriately.
Annual Performance Evaluation, Single analyzer	Every site 1/year 25 % of sites quarterly	Percent difference of audit levels 3 - 10 <± 15.1%; Audit levels 1 &2 <±15 ppb difference or <± 15.1%	3 consecutive audit concentrations not including zero. 40 CFR Part 58 App A sec 3.1.2; AMTIC technical memo/guidance	Repair / replace components as indicated. Repeat 5-point calibration.
Annual Performance Evaluation, Federal Audits (NPAP)	1/year at selected sites 20% of sites audited	Audit levels 1 &2 <±1.5 ppb; All other levels mean absolute difference <± 10%	40 CFR Part 58 App A sec 3.1.3	
Annual Performance Calibration	Upon receipt, adjustment, every 182 days.	Greatest of all points <± 2.1 % or <± 1.5 ppb of best-fit straight line; Linearity error <± .05	Multipoint calibration (0 and 4 upscale points); 40 CFR Part 50 App D sec 4.5.5.6	
Annual Performance Evaluation, Zero Air	1/year	Concentrations below LDL	40 CFR Part 50 App D	

Requirement	Frequency	Acceptance Criteria	Information/Action	Corrective Action
Ozone Transfer standard, Qualification Level 2 or 3	After qualification and upon receipt/adjustment/repair	<± 4.1% or ± 4 ppb (whichever greater)	Transfer Standard Guidance EPA-454/B-13-004 October 2013.	
Ozone Transfer standard, Certification Level 2 or 3	After qualification and upon receipt/adjustment/repair	RSD of 6 slopes no greater than 3.7%. SD of intercepts <=1.5	Transfer Standard Guidance EPA-454/B-13-004 October 2013.	
Detection, Noise	1/year	0.0025 ppm hi/0.001 ppm lo	40 CFR Part 53.20, 53.23	
Detection, Lower detectable level	1/year	0.005 ppm hi/0.002 ppm lo	40 CFR Part 53.20, 53.23	

Additional Operational Data

Data exceeding preset thresholds for stuck, jump, and other qualifiers are automatically flagged by the QREST software upon transfer. Prior to submission to AQS all data are manually validated, and additional flagging may be added if other problems are identified (see Appendix A below). A 5-point calibration will be scheduled and run if data do not meet quality assurance criteria. Instrument components will be serviced as needed.

Table 14-3. Systematic Criteria. Element 14c (B5-3)

Requirement	Frequency	Acceptance Criteria	Information/Action	Corrective Action
Standard Reporting Units	All data	ppm (final units in AQS)	40 CFR Part 50	
Completeness	Daily, 8-hour	75% of hourly averages for the 8-hour period, 75% of 8-hour averages for the 24-hour period	8-Hour Average	
Completeness (seasonal)	3-Year Comparison	90% of season; 75% of year	40 CFR Part 50	
Sample Residence Times		< 20 seconds	40 CFR Part 58. Monitor inlet and analyzer location do not change	
Sample Probe, Inlet, Sampling train		Teflon	40 CFR Part 58	
Siting		Un-obstructed probe inlet	40 CFR Part 58 Monitor inlet and analyzer location do not change	
EPA Standard Ozone Reference Photometer Recertification	1/year	Regression slope = 1.00 + 0.01 and intercept <+ 1 ppb	Table 3-1, Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone, Technical Assistance Document, October 2013, EPA-454/B-13-004)	
Precision (using 1-point QC checks)	Calculated annually and as appropriate for design value estimates using DASC	90% CL CV <=7%	90% Confidence Limit of coefficient of variation. 40 CFR Part 58 App A sec 4.1.2	Repeat 5-point calibration. Repair / replace components as needed.

Bias (using 1-point QC checks)	Calculated annually and as appropriate for design value estimates using DASC	95% CL <= ± 7%	95% Confidence Limit of absolute bias estimate. 40 CFR Part 58 App A sec 4.1.3	

Data completeness for monthly datasets is automated by the QREST software upon submission to the system. Additional manual validation takes place prior to submission to AQS. Sample residence, siting, and sampling train are verified annually. Data are to be evaluated using the EPA DASC tool (version available as of 2020 and presented in the APTI SI-470 Course), incorporating the following calculations.

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

Criterion	Equation	Equation Number
Single-Point QC Check. For each single point check, calculate the relative percent difference, d_i, where Y_i is the concentration indicated by the monitoring organization's instrument and Xi is the audit concentration of the standard used in the QC check being measured.	$d_i = \frac{Y_i - X_i}{X_i} \times 100$	1
Overall QC Check Result. Calculate the coefficient of variation upper bound, where X0.1, n-1 is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom.	$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$	2
Average Absolute Percent Difference. The quantity AB is the mean of the absolute values of the relative percent differences and will be calculated from equation 4 or using the AVERAGE function in an Excel spreadsheet.	$AB = \frac{1}{n} \cdot \sum_{i=1}^{n} \lvert d_i \rvert$	4
Bias Estimate. Bias is estimated using an upper bound on the mean absolute value of the percent differences where n is the number of single point checks; $t_{0.95, n-1}$ is the 95th quantile of a t-distribution with n-1 degrees of freedom.	$\lvert bias \rvert = AB + t_{0.95,n-1} \cdot \frac{AS}{\sqrt{n}}$	3
Standard Deviation of the Absolute Percent Differences. AS is the standard deviation of the absolute values of the percent differences and will be calculated from Equation 5 or using the STDEV function in an Excel spreadsheet.	$AS = \sqrt{\frac{n \cdot \sum_{i=1}^{n} \lvert d_i \rvert^2 - \left(\sum_{i=1}^{n} \lvert d_i \rvert\right)^2}{n(n-1)}}$	5
Assigning a Sign (Positive/Negative) to the Bias. The absolute bias upper bound should be flagged as positive if both 25th and 75th percentiles are positive and flagged as negative if both percentiles are negative. The absolute bias upper bound would not be flagged if the 25th and 75th percentiles are of different signs.	if $z_{0.25} > 0$ and $z_{0.75} > 0 \rightarrow +\lvert bias \rvert$ if $z_{0.25} < 0$ and $z_{0.75} < 0 \rightarrow -\lvert bias \rvert$ else $\rightarrow \pm\lvert bias \rvert$	
25th Percentile of the percent differences. The 25th percentile of the percent differences d_i for each site will be calculated using rank ordering of the percent differences or the QUARTILE function in an Excel spreadsheet.	*Calculated using rank ordering of the percent differences.*	
75th Percentile of the percent differences d_i. The 75th percentile of the percent differences d_i for each site will be calculated using rank ordering of the percent differences or the QUARTILE function in an Excel spreadsheet.	*Calculated using rank ordering of the percent differences.*	

Criterion	Equation	Equation Number
Probability limits will be calculated from the one-point QC checks d_i values using equations 6 and 7 where m is their average over the time period being evaluated from equation 8 and S is the standard deviation of the percent differences. 95% of the individual percent differences (all checks) for the performance evaluations should be within this probability interval.	EPA DASC Tool	NA

Quarterly precision. Element 14e (B5-5)
For the gaseous pollutants like O3, the acceptance limit is a 90% confidence limit applied to the set of all QC checks made over three years. This means that the data conform to the DQOs if there is 90% confidence that the precision uncertainty, as measured by the QC checks for precision using a known gas concentration, is less than the acceptance limit (7% for ozone). However, if one or two QC check results are slightly greater than the acceptance limit but most are less than the acceptance limit there may not be a reason for concern. This is because there is some chance that individual checks may produce results with greater than the acceptance limits just by chance, even when the system is running correctly and is 'under control.' Data are to be evaluated using the EPA DASC tool (version available as of 2020 and presented in the APTI SI-470 Course), charting the results per quarter and per year, with calculation of 90% confidence limits for precision, if some results are greater than 7%. (Note that if all results are less than the acceptance limit (7%) then these confidence limits do not need to be calculated, because the overall estimates of uncertainty for precision will be less than 7%.)

The average and range of the precision checks will be reviewed at least every quarter. If any results fall outside of within 7% of the mean of the known concentration, the results will be carefully reviewed to determine validity of the data after the out-of-limits check occurred.

Accuracy or total error checks. Element 14f (B5-6)
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, or by a qualified contractor but it must not have been calibrated with the same primary standard as the field equipment against which is to be compared.

Various accuracy checks are implemented in this air monitoring program: periodic performance audits conducted by Environmental Management Office, outside contractor, and participation in the National Performance Audit Program (NPAP) performance audits when possible. These evaluations are discussed in the following sections. Currently, T&B Systems is the contractor that performs the audits. The results from any of these comparisons will be entered into the DASC tools, for analysis of trends which may signal future problems.

Performance audits. Element 14g (B5-7)
Performance evaluations are a type of audit in which quantitative data generated by an outside measurement system are compared to the Tribe's routinely obtained data to evaluate that the Tribe's data is within acceptable bias. The audit is conducted by challenging the instrument with a standard of

known concentration and quantifying the difference between the outside value and the Tribe's routinely obtained value. This section describes the various types of performance audits conducted in the program.

An annual performance audit on the O3 analyzer will be conducted annually by T&B Systems, GBUAPCD or another qualified auditor selected by the Tribe. A transfer standard and the monitoring station's O3 analyzer measure the same ozone concentrations at the same time. The responses of the on-site analyzer are then compared against the output of the transfer standard. The concentration differences between the outside standard and the field analyzer for each level are compared to ensure they are within the specified allowed error, and if not, the system is calibrated. The concentration differences will be compared against the confidence intervals calculated using the EPA DASC tool as described above. If any audit results fall outside these limits, the analyzer will be checked and may have to be recalibrated.

Single-check accuracy. Element 14h (B5-8)
The Results of performance evaluations will be used in calculations via the EPA DASC tool. The tool calculates (d_i) ultimately for percent difference for a single audit using equation 14.1, where Y_i is the concentration reported by the field analyzer and X_i is the concentration of the audit "known" standard.

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

Equation 14.1

Independent Audits. Element 14i (B5-9)
The National Performance Audit Program (NPAP) audits and technical reviews will be conducted by US EPA Region 9 personnel in accordance with all applicable EPA SOPs as resources are available at the Region level. 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. Element 14j (B5-10)
Not applicable.

QAPP - INSTRUMENTATION 15. Element 15 (B6)

Instrumentation. Element 15a (B6-1)
This section describes the procedures used to verify that all instruments and equipment are maintained in sound operating condition and are capable of operating at acceptable performance levels. All instrument inspection and maintenance activities are documented in the following: ''Model 49i Instruction Manual 2006.''

Inspection. Element 15b (B6-2)
The O3 analyzer used in this network is a designated federal equivalent method (FEM) that has been certified as such by U.S. EPA. Therefore, is assumed to be of sufficient quality for the data collection operation. Testing of such equipment is accomplished by U.S. EPA through the procedures described in 40 CFR Part 50.

The Air Quality Specialist will perform a multi-point verification checks before gathering any data. If any of these checks are out of specification (the MQO is all points < + 2.1 % or < +1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 + .05), Air Quality Specialist will contact the vendor for initial corrective action. If the analyzer instrument meets the acceptance criteria, it will be assumed to be operating properly. These tests will be properly documented and filed as indicated in Element 9.

Table 15-1. Maintenance and Inspection of Equipment during Field Operations

Item	Frequency	Parameter	Action	Documentation
Shelter temp.	Every site visit	Thermometer	Check thermostat	Site logbook, field form
Air Conditioner	Monthly	Adjust range	Check HVAC; repair if needed	Site logbook, field form
Heater	Monthly	Thermostat	Check Heater; repair if needed	Site logbook, field form
Sample inlet	Every site visit	Clear opening	Clear obstruction	Site logbook
Meteorological sensors	Quarterly	Sensor output	Repair, calibrate	Site logbook
Sample pump	Monthly	Flow	Replace with spare; re-build	Site logbook, field form
Particulate filter	Quarterly	Clear flow	Replace	Site logbook, field form
DAS	Daily	Signal acquisition	Repair	Site logbook, field form
Analyzer(s)	Each visit	Reasonable	Repair, calibrate reading	Site logbook

QAPP - INSTRUMENT CALIBRATION. Element 16 (B7)

Definitions. Element 16a (B7-1)
This program uses the ozone generator certified as ozone transfer standard method, the T703U. It is operated as a system in the same location as the ozone analyzer. This generator/analyzer combination serves as the tribe's ozone transfer standard. It is used for regular span/zero verification, biweekly 1-point precision verification and 5-point calibrations, and is compared to a certified ozone transfer standard annually.

Calibration hierarchy. Element 16b (B7-2)
On a regular schedule, span/zero, 1-point precision checks and 5-point calibrations are conducted on the 49i monitor, using the T703U calibrator. Annually, the system is verified through an external audit conducted by T&B Systems, using instruments that can be verified back to a primary standard.

Local standard. Element 16c (B7-3)
In a typical verification of the local/field standard (Thermo 49i), the output of the transfer standard (T703U) is compared with the output of a Level 3 standard. This comparison is performed throughout the operating range, and including zero, to establish a linear relationship between the transfer standard and the primary standard. Agreement should be very strong as shown in the table below.

Table 16-1. Calibration Requirements

Equipment Used to Calibrate Field Equipment	Acceptance Criteria	Frequency
A. Transfer Standard ozone generator certified as Level 3 ozone transfer standard These comparisons are made against a Level 2 standard, i.e., the EPA SRP 36.	Single point difference < 3.1%	Annually
B. Local Primary Standard operating range Compared against the transfer standard described in row A.	Regression slopes = 1.00 ±0.03 and all intercepts are 0 +/- 3 ppb.	Annually

Standards for pressure and temperature. Element 16d (B7-4)
It is possible to operate the analyzer in temperature or pressure compensation mode, so the operator can view a display of actual changes in gas temperature or pressure. Calibration of temperature and pressure sensors is not recommended by the manufacturer for the analyzer model.

QAPP - SUPPLIES AND CONSUMABLES. Element 17 (B8)

Acceptance criteria must be consistent with overall project technical and quality criteria. Some of the acceptance criteria are specifically detailed in 40 CFR Parts 50. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

Receiving personnel will perform a rudimentary inspection of the packages as they are received from the courier or shipping company. Any obvious problems with a receiving shipment such as crushed box or wet cardboard will be noted. The package will be opened, inspected and contents compared against the packing slip. If there is a problem with the equipment/supply, it will be noted on the packing list, and the vendor will be contacted.

If the equipment / supplies appear to be complete and in good condition, the packing list will be signed and dated and sent to accounts payable so that payment can be made in a timely manner. Equipment / supplies will be stocked in the Air Lab in the Environmental Management Office. A list of supplies will be maintained, and the number of items received and used will be noted so that new items can be ordered in time for their use.

QAPP – NON-DIRECT MEASUREMENTS. Element 18 (B9)

This element addresses data not obtained by direct measurements. This includes both outside data and historical monitoring data.

1. Chemical and Physical Properties Data
   Chemical and physical 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. The following sources may be used in the monitoring program without extensive review of their QC requirements:
   - National Institute of Standards and Technology (NIST)
   - International Organization for Standardization (ISO), International Union of Pure and Applied Chemistry (IUPAC), American National Standards Institute (ANSI), and other widely recognized national and international standards organizations
   - U.S. EPA
   - Current guidance documents issued by federal agencies may be used without prior approval.

2. Geographic Location
   Another type of data that will commonly be used is geographic information. For identifying the location of sampling sites conventional longitude and latitude coordinates, or UTMs are reported.

3. Historical Monitoring Information
   Historical monitoring data and summary information derived from previous data collected by GBUAPCD and the National Park Service may be used in conjunction with current monitoring results to calculate and report trends in pollutant concentrations. In calculating historical trends, we will verify that historical data are fully comparable to current monitoring data. If different methodologies were used to gather the historical data, the biases and other inaccuracies must be described in trends reports based on that data.

4. Meteorological Data from Other Sources
   Meteorological data from the Bishop Tribe's site and from the nearby Bishop Airport site operated by the National Weather Service will be used for siting purposes, may be used for computing corrections needed to convert from standard conditions to local conditions if needed, and to support analysis and modeling efforts.

QAPP - DATA MANAGEMENT. Element 19 (B10)

Recording. Element 19a (B10-1)
Data entry, validation, and verification functions are all integrated in the database. Procedures for manual validation prior to AQS submission are provided in SOPs.

The data reside on a database maintained as part of the QREST network and reside at Northern Arizona University.

Security of data is ensured by the following controls:

- Password protection on the database that defines levels of access to the data. Only the Air Quality Specialist and authorized ITEP-NAU personnel have rights to access the system.
- Public data access is via the QREST and the Bishop Tribe's website, for viewing or download only (no write permissions).
- Data validation and coding are available only through a credentialed cloud account in QREST.

Raw O3 data, recorded in ppb, will be retained analyzed.

Transformation and reduction. Element 19b (B10-2)
To attain the Tribe's 8-hour standard of 0.070 ppm (70 ppb):

1. calculate values for every rolling 8-hour period in the day (values roll from one day into the next)
2. the highest 8-hour average from each day is determined (there might be some 8-hour averages that overlap midnights, but it is unlikely)
3. if there are not 18 valid hourly results in a 24-hour period AND none of the 8-hour rolling averages are greater than the standard then that day will not used
4. if there are not 18 valid hourly results in a 24-hour period BUT there are 8-hour averages ABOVE the standard then that less-than-8-hour averages IS used in the computation of the standard
5. the highest 8-hour averages in each year are ranked
6. there should be at least 90% of the possible days in the ozone season with 8-hour averages for that day
7. this value is compared with the Tribal standard.

The Tribe's one-hour average standard is met when the expected number of (midnight to midnight) days per calendar year with a maximum hourly average concentration above 0.09 ppm is equal to or less than 1. Daily exceedances at the monitoring site are recorded for each calendar year to determine if this average is less than or equal to 1. Specific information on incomplete hours and days is found in 40 CFR 50 Appendix H.

In general, the average number of days per year above the level of the standard must be less than or equal to 1. In its simplest form, the number of exceedances each year would be recorded and then averaged over the past three years to determine if this average is less than or equal to 1.

Let z denote the number of missing values that may be assumed to be less than the standard. Then the following formula shall be used to estimate the number of exceedances for the year:

$$e = v + [(v/n)\ (N-n-z)] \quad (1)$$

where

N = the number of required monitoring days in the year
n = the number of valid daily maxima
v = the number of measured daily values above the level of the standard
z - the number of days assumed to be less than the standard level, and
e = the estimated number of exceedances for the year.

This estimated number of exceedances shall be rounded to one decimal place (fractional parts equal to .05 round up).

The term “daily maximum value” refers to the maximum hourly ozone value for a day. As defined in Appendix H, a valid daily maximum means that at least 75 % of the hourly values from 9:01 A.M. to 9:00 P.M. (LST) were measured or at least one hourly value exceeded the level of the standard. This criterion is intended to reflect adequate monitoring of the daylight hours while allowing time for routine instrument maintenance. The criterion also ensures that high hourly values are not omitted merely because too few values were measured. Note that N is always equal to the number of days in the year unless the tribe obtains other information from the EPA regional office.

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 Quality Specialist 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. (This is covered in more detail in Appendix A SOPs.)

Data are validated in 2 ways; automatically and then manually. The QREST software automatically flags data that limits in acceptance, i.e., the data do not produce a numeric result or exceed maxima, minima, amount change or stuck values. Data which produced a numeric result but is qualified in some respect related to the type or validity of the result, or produced a numeric result but for administrative reasons is not to be reported, are validated manually in QREST. These flags remain in the data as part of the validation process. Both QREST and an additional software Vista Data Vision are configured to send automated email alerts which notify the operator when a pre-set instrument parameter threshold is reached. The emails are timestamped for verification purposes and retained in an archive. Automated alerts are verified as they arrive on a real-time basis. The Air Quality Specialist uses these alerts to identify invalid data or an immediate need to check the instrument.

During the course of manual validation, the Air Quality Specialist may verify the automatic flags, set additional flags, or reclassify flagged data as ambient if it were flagged erroneously. Appendix A contains a complete list of the data qualifiers. The elements which validation reviews are those, which for ambient concentrations, determine conformance to specifications for annual performance evaluations (audits) and calibrations- zero/span and precision checks. Validation notes entered manually are recorded each validation session and describe the reasons for flagging, including results that may be suspect due to contamination, special events, or failure of QC limits.

The transmittal of data to AQS has automated and manual components. QREST generates an AQS file

using user-specified selections such as dates and parameters, performed while logged into the secure system. This file is downloaded by the user from the QREST website to a password-secured local computer, archived, reviewed, then submitted to AQS via EN Services. A later version of QREST that automatically sends the file to AQS when prompted by user interfaces is currently being tested by ITEP.

Table 19-1. Transmittal Data

Description	Originator	Recipient	QA Measures	Responsible	Comments
Electronic Data Transfer	Field monitor	QREST DAS	Automated qualification & flagging, Transmission Protocols		
Calibration and audit data	Air Quality Specialist and/or auditing contractor	EPA project officer, TEPA	Copies of reports are given	Air Quality Specialist	Contained in quarterly reports as needed
Maintenance schedule status	Air Quality Specialist	QA Manager	Records due and completed dates of tasks & QA Mgr initial,	Air Quality Specialist	
AQS submittal data	(formerly TrEx) QREST software	EPA	QREST automatically generates AQS file	File retrieval by Air Quality Specialist	Submittal via ENServices to AQS
AQS data summaries	Air Quality Specialist	EPA Region	Printed AMP 350 report in file; email to Project officer; manual validation prior to AQS submission	Air Quality Specialist	Master hard copy used; scanned copy kept on file.

Management. Element 19d (B10-4)
The data generated by the field instrumentation are captured, organized, and verified (reviewed and judged compatible with this QAPP's requirements) in order to be useful for this project. The process of capturing the data is known as data acquisition, whereas the organization of the data is known as data management. Within both of these areas, quality assurance efforts and data reviews are carried out to verify the quality of the ambient data. The procedures rely on digital communication by the DAS to collect information from the gas analyzers, control instrument response factors, and execute routine, automated, and thorough data quality checks and calculations.

Section 9 discusses how the data files will be named and describes the file structures.

The Sutron XLite data logger will be the primary part of the DAS. Data sampling rates of 2 seconds and averaging period of 5 minutes are used. Data are transferred to the QREST server. Data can be averaged, archived, displayed or downloaded.

The XLite facilitates data acquisition at a monitoring site, as well as having the capability of remote control of calibrator operations. All communication is web based and secure. Digital communication and data acquisition means that the Sutron system can access the internal software of an instrument (and optionally control the device's internal settings and parameters). Basic analyzer settings, such as the time and date, measurement range, units of concentration, time constant or averaging time, and zero and calibration factors, can be controlled by the Sutron system.

Security of data is ensured by the following controls:

- Password protection on the database that defines levels of access to the data. Only the Air Quality Specialist and authorized ITEP-NAU personnel have rights to access the system.

- Read-only data available through public websites
- Data validation and flagging available through a credentialed cloud account.

Storage. Element 19e (B10-5)
Raw data delivered from the logger to QREST is retained on the QREST server since the inception of QREST, and since the inception of monitoring, when data was stored in TrEx, data downloaded from TrEx are stored in raw data download files, files copied from the online display, and AQS files, and are readily available for audits and data verification activities. The QREST server is routinely backed up. Data archival policies for the data are listed in following table. Security of data in the database is ensured by password protection and secure web connections. Raw data downloaded from the datalogger (for the purpose of analyzing with the EPA DAS tool) is stored in dedicated folders, including one for original data with no changes made; and one which has the DASC calculations, organized by date. All downloaded data is stored on or backed up to a computer in the Air Quality Office, which is backed up weekly to the Tribal network (which is backed up daily).

Table 19-2. Storage Data

Data Type	Medium	Location	Retention Time	Final Disposition
Field Notebooks	Hardcopy, scanned copy	Site and archived in office when full	5 years	NA
Database	Electronic (on-line)	QREST server, Northern Arizona University	since site inception	NA
Data files	Electronic, extracted	Tribal computer & back up location	All data is retained	NA

Retrieval. Element 19f (B10-6)
Data are available on the QREST website:
https://www.qrest.net/Home/ReportDaily/e397410e-8bbc-4dee-8783-e21a95a79916
And also at
http://www.bishoptribeemo.com/monitoring.htm

QAPP - 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, "assessment" is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

Network Reviews. Element 20a (C1-1)
The network review is an annual review, used to determine how well a particular monitoring network is achieving its required air monitoring objectives, and how it should be modified to continue to meet its objectives. This might include relocating monitors due to changed traffic patterns, construction, growth of vegetation, etc.

Prior to the implementation of the network review, significant data and information pertaining to the review is compiled and evaluated. It will include the following:

- network files (including updated site information and site photographs)
- AQS reports
- air quality summaries for the past five years for the monitors in the network
- emissions trends reports for other relevant monitors in the region

Upon receiving the information, it is checked to ensure it is the most current. Discrepancies are noted and resolved during the review. Files and/or photographs that need to be updated will also be identified. Adequacy of the location of monitors can only be determined based on stated objectives. During the network review, the stated objective for the monitoring site (see section 10) are reconfirmed and the spatial scale re-verified and then compared to determine whether these objectives can still be attained at the present location.

An on-site visit will consist of the physical measurements and observations to determine compliance with the requirements, such as height above ground level, distance from trees, paved or vegetative ground cover, etc. Since many of these conditions will not change within one year, this evaluation at each site is performed every 3 years.

In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- installation of new monitors
- relocation of existing monitor
- siting criteria problems and suggested solutions
- problems with data submittals and data completeness
- maintenance and replacement of existing monitor and related equipment
- quality assurance problems
- air quality studies and special monitoring programs
- other issues, such as community concerns
- proposed regulations
- funding

A report of the network review is written within two months of the review (Section 21) and appropriately filed (Section 10).

Performance evaluation. Element 20b (C1-2)
A performance evaluation is a quantitative comparison of results between the tribe's equipment and equipment calibrated by another primary standard. This is done through the EPA regional office in the form of participation in the National Performance Audit Program (NPAP). Successful participation requires an agreement of less than 10% between the auditor's equipment and the tribe's equipment. This Environmental Management Office will participate in NPAP as arranged and agreed to with the EPA regional office provided resources are available.

Technical systems audit. Element 20c (C1-3)
A system audit is a thorough and systematic onsite qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. T&B Systems will conduct the system audit. The auditor will perform three system audit activities that may be completed separately or combined:

- Field
- Data management – including information collection, validating, and security
- Key personnel – including interviews with individuals responsible for planning, field operations, QA/QC, data management including validation, and reporting.

To ensure uniformity of the system audit, an audit checklist will be used.

T&B Systems will send a copy of the final system audit report to the Bishop Tribes' Air Quality Program, who will forward the information to US EPA Region 9 as part of regular grant reporting activities. Any corrective action taken will be included in the report to US EPA Region 9.

Post-Audit Activities – The major post-audit activity is the preparation of the system audit report. The report will include:

- Audit team leaders, audit team participants and audited participants
- Background information about the project, purpose of the audit, dates of the audit, particular measurement phase or parameters that were audited, and a brief description of the audit process
- Summary and conclusions of the audit and corrective action required
- Attachments or appendices that include all audit evaluation and audit finding forms

To prepare the reports, the audit team will meet and compare observations with collected documents and results of interviews and discussions with key personnel. Expected QA Project Plan implementation will be compared with observed accomplishments and deficiencies and the audit findings will be reviewed in detail. The system audit report will be submitted to the Bishop Tribe's Environmental Management Office and Air Program for review and comment.

If the Environmental Management Office and/or Air Program have written comments or questions concerning the audit report, the audit team will review and incorporate them as appropriate, and subsequently prepare and resubmit a report in final form following receipt of the written comments. The report will include an agreed-upon schedule for corrective action implementation.

Follow-up and Corrective Action Requirements – The auditor and the Bishop Tribe's Air Program may work together to solve required corrective actions which are identified during an audit. The Bishop Tribe's Air Program has 30 days to respond to the follow-up and corrective action requirements in the system audit report. The audit team will review the Bishop Tribe's Air Program responses to the follow-up and corrective action and will work with the Bishop Tribe's Air Program to resolve any discrepancies. Corrective actions take place as soon as practicable, and as a minimum, acknowledgement is made that the problem exists until it is feasible to address it. The QA manager will be informed of all actions as part of the quarterly QA meetings (see Appendix B), which are recorded with signatures or initials. Actions are also reported in regular reports.

Data Quality Assessments. Element 20d (C1-4)
Data quality assessments are statistical and scientific evaluations of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use.

The Air Quality Specialist is responsible for conducting an ongoing review of the data. The field data sheets, computer files, and final reports will be assessed to make sure that the results are accurate. Any data that is found to contain errors is described in the Air Quality Specialist's logbook or in the web-based operator's log. Original data will always be kept, and archived with a note or flag indicating any issues or concerns.

Others. Element 20e (C1-5)
None

QAPP - REPORTS TO MANAGEMENT. Element 21 (C2)

Reports to Tribal authorities. Element 21a (C2-1)
There are various types of routine monthly reports made to the tribal authorities.

- A monthly report to the Tribal Environmental Protection board that describes air quality conditions during the previous month, along with any issues with air monitoring equipment, and any other air-quality-related activities.
- Ongoing reports are made to Tribal Administration, specifically each time expenditures are incurred for work plan tasks. It is necessary to document and explain the relevance of all activity related to contractual work, travel and training, orders, purchasing, and official documents that the Air Program accomplishes.
- Reports directly to the QA Manager for air monitoring are conducted quarterly for the purpose of tracking scheduled maintenance status, during which the QA Manager reviews the QA checklists for each monitor.
- Quarterly QA oversight report from QA Manager to the Environmental Director and as desired the TEPA Board.

Reports to EPA. Element 21b (C2-2)
Following submission of this QAPP, the Air Quality Specialist will provide a list of all monitoring sites, and their AQS site identification codes to the US EPA Office, with a copy to the Aerometric Information Retrieval System Air Quality Subsystem (AQS). The AQS is US EPA's computerized system for storing and reporting of information relating to ambient air quality data. Whenever there is a change in this list of monitoring sites in a reporting organization, the Air Quality Specialist will report this change to the USEPA Region 9 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 9.

Each quarter, the Bishop Tribe's Air Program reports the results of all precision and accuracy tests it has carried out during the preceding quarter to AQS. The quarterly reports are submitted, consistent with the data reporting requirements specified for air quality data as set forth in 40 CFR 58.16

Required accuracy and precision data are to be reported on the same schedule as quarterly monitoring data submittals. The required reporting periods and due dates are listed in Table 18.

Table 18. Quarterly Reporting Schedule

Reporting Period	Due On or Before
January 1 – March 31	June 30
April 1 – June 30	September 30
July 1 – September 30	December 31
October – December 31	March 31 (following year)

Air quality data submittal for each reporting period are edited, validated, and entered into the AQS using the procedures described in the AQS Users Guide, Volume II, Air Quality Data Coding. The Air Quality Specialist is responsible for preparing the data reports for transmission to EPA. QREST has the capability of automatically generating AQS reports, following manual validation. The AQS files are transmitted via EPA EN Services secure web portal. This automated electronic system avoids any transcription or data entry errors that might otherwise occur in the report generation process.

Internal (Tribal) QA reports. Element 21c (C2-3)
Internal QA issues are documented in monthly reports to the QA Manager and/or the Tribal Environmental board and in special reports as needed.

Other Reports. Element 21d (C2-4)
None

QAPP - 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:

1. The critical requirements listed in table 14-1 Critical Criteria Table (Section 14a) apply to all data. If any particular data point does not meet each and every criterion on the Critical Criteria Table, that point will be invalidated unless there are compelling reason and justification for not doing so. 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.
2. The operational requirements listed in table 14-2 Operational Criteria Table (Section 14b) are 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.
3. The 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 any decisions made based on the data.

QAPP - VALIDATION AND VERIFICATION METHODS. Element 23 (D2)

Validation and verification methods. Element 23a (D2-1)
This section describes how the Environmental Management Office verifies and validates data collection operations.

Verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Verification 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 gathered are useful for your purpose. Although there are a number of objectives of ambient air data, the major objective for the Air Quality Program network is for comparison to the Tribal standard and therefore, this is identified as the intended use.

This section will describe the verification and validation activities that occur at a number of the important data collection phases. 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 Management Office uses qualitative assessments (e.g., technical systems audits, network reviews) to verify that the QAPP is being followed, and relies on the various quality controls, inserted at various phases of the data collection operation, to validate that the data will meet the DQOs.

Sampling design. Element 23b (D2-2)
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 Management Office can determine whether monitors should be relocated, new monitors or monitor types purchased, etc. This information is included in network review documentation.

Data Collection Procedures. Element 23c (D2-3)
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 are described in section 14(B5) are used to validate these activities.

Quality Control Procedures. Element 23d (D2-4)
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. Element 14 (B5) describes the techniques used to document QC review/corrective action activities.

Routine instrument performance checks are performed and recorded on dedicated field forms to ensure stable performance. The analyzer and calibrator each are inspected according to a dedicated QA checklist, or maintenance schedule. If degradation in instrument performance is observed during routine checks, calibration or maintenance, it will indicate some change in the system. The Air Quality

Specialist receives automated email alerts if the data logger records levels outside an operator-defined preset threshold or range. Any instrument or concentration data that indicates unacceptable levels of bias or precision will be flagged and investigated and incidence recorded in the instrument logbook. Corrective action will be taken as needed. Validation includes the review of the documentation to ensure corrective action was taken as prescribed in the QAPP.

Data Reduction and Processing. Element 23e (D2-5)
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. As per QREST program design, condition flags never internally overwrite numerical data stored in the database (with the exception of lost data). Flags denoting error conditions or QA status are saved as separate fields in the database, so that it is possible to recover the original data.

The following QC functions are incorporated into the automated flagging capabilities of the QREST database to ensure quality of data entry and data processing operations:

- Range Checks – all monitored parameters have simple range checks programmed in. Since these range limits for data input are not regulatory requirements, the Air Quality Specialist may adjust them from time to time to better meet quality goals.
- Completeness Checks – when the data are processed certain completeness criteria must be met. These are automatically checked by the QREST software.
- Internal Consistency and Other Reasonableness Checks -- several other internal consistency checks are made by the Air Quality Specialist. These include checks for regular diurnal and seasonal patterns. Additional consistency and other checks are implemented as the result of problems encountered during data screening. The program receives input following examination of consistency in data generated by the monitor via audits and evaluations performed by contracted parties as described in previous sections.
- Data Retention – Data previously on the TrEx system are maintained by the Tribe since monitoring inception until the replacement of TrEx with QREST- and these records are currently maintained. The Air Program retains all extracted monitor data.

QAPP - RECONCILIATION WITH USER REQUIREMENTS. Element 24 (D3)

The data used in decisions on attainment or non-attainment of the Tribal air quality standards are never error free and will always contain some level of uncertainty. Because of these uncertainties or errors, there is a possibility that Environmental Management Office may declare an exceedance when the concentrations do not exceed the Tribal standard (false positive error) or good air quality when the concentration is actually in above the Tribal air quality standard (false negative error). There can be serious political, economic and health consequences of making such decision errors. Therefore, Environmental Management Office has set limits on the probabilities of making incorrect decisions with these data. In order to set probability limits on decision errors, Environmental Management Office needs to understand and control uncertainty. Uncertainty is used as a generic term to describe the sum of all sources of error associated with a measurement result.

This QA element is sometimes called Quality Improvement. This is the time when the data and overall quality system is reviewed with the help of hindsight to determine if we have made the correct QA choices.

As data are gathered and prior to issuing any final reports, the data are reviewed, evaluated and documented to detect any errors. Some of the questions asked include:

Quantitative. Element 24a (D4-1)

- Is the data more or less variable (predicted coefficient of variation) either in time or in space than expected? (Implying the sampling frequency or sampling network may need to be increased or decreased)
- Do the results of monitoring indicate a measured concentration consistently far above, far below or near the action levels/standards? Levels near the standard may indicate the need for additional and/or more frequent monitoring.
- Do the monitoring data and/or circumstances indicate that monitoring is not necessary?
- Have the correct amount of resources been allocated to monitoring?
- Are there developments that may impact monitoring or QA design (technological developments)?
- Are there any other changes to the quality assurance and monitoring design that would be beneficial?

Qualitative. Element 24b (D4-2)

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 section of the QAPP will outline the procedures that the Environmental Management Office 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 Management Office will generate some summary statistics for its

analyzer 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 month.

Other questions that are asked during this process include:

- Were the Tribal standards set at the correct levels?
- Have the correct amount of resources been allocated to monitoring?
- Are there developments that may impact monitoring or QA design (technological developments in terms of new equipment available)?
- Are there any other changes to the quality assurance and monitoring design that would be beneficial?

There may be reasons to assess changes in the standards that are being used, including:

- Is there more information on health impacts that can be used to modify standards?
- Are there new monitoring objectives that require changes to standards?
- Are there legal or political realities that dictate a change to standards?

This process includes asking the following questions regarding resource allocation:

- Is the data more or less variable (predicted coefficient of variation) either in time or in space than expected? (Implying the sampling frequency or sampling network may need to be increased or decreased)
- Do the results of monitoring indicate a measured concentration consistently far above, far below or near the action levels/standards. The ability to reduce sampling frequencies. Levels near the standard may indicate the need for additional and/or more frequent monitoring.
- Do the monitoring data and/or circumstances indicate that monitoring is not necessary? (After the phase out of leaded fuels monitoring for lead was discontinued in many areas)

There also may be new developments that can affect the study design, including:

- Is a new monitoring instrument available that is preferable to the method currently used?

Other QA considerations include:

- Is there a preventable condition that is causing data to be unusable or lost? (computer “lock-ups”)
- Were the quality control criteria selected appropriate to meet quality objectives? (Should criteria be loosened to save resources or tightened to meet the DQOs?)

REFERENCES

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B. EPA 454/R 98 017, GUIDELINE ON DATA HANDLING CONVENTIONS FOR THE 8 HOUR OZONE NAAQS, December 1998.

C. QA Handbook for Air Pollution Measurement Systems, Volume ii: Ambient Air Quality Monitoring Program, EPA-454/B-08-003, 2013 and 2017 Appendix D.

D. Technical Assistance Document EPA-454/B-10-001.

E. QREST user guide, Institute for Tribal Environmental Professionals, 2020.

APPENDIX A. STANDARD OPERATING PROCEDURES AND FIELD FORMS

SOP 1 DATA TRANSFER, VALIDATION AND ANALYSIS

SOP 2 INSTRUMENT MAINTENANCE AND CALIBRATION

OZONE INSTRUMENTS MAINTENANCE SCHEDULE

OZONE INSTRUMENTS MONTHLY/QUARTERLY/ANNUAL CHECK FORMS

703U CALIBRATOR OPERATIONAL STATUS CHECK FORM

EPA DASC TOOL CALCULATIONS

SOP 1 - DATA TRANSFER, VALIDATION AND ANALYSIS

Transfer

Analog information from the Thermo 49i monitor is automatically transferred to the data logger. This data logger automatically transfers data to the remotely located QREST server via network. Subsequently, data are to be automatically transferred to the US EPA AirNow data base.

Validation

Validation is a 2- part process for ozone data. 5-minute and hourly data are reviewed. Initial screening of the data occurs with determining the results of the biweekly zero-span and single point precision checks (and semiannual calibration), which is done via the QREST software developed by ITEP (www.QREST.net), excel, or R Studio. 5-min data is used for this step, from either the logger or QREST. Validation is recorded in monthly data sets of hourly records in QREST, which will be converted by the software to AQS files. Standard AQS null value codes are available in the software to append to data records. All the codes in QREST will be accepted by AQS; however, Table A-1 below contains the codes used most frequently by the BPT Air Program (see below in 3. MANUAL VALIDATION IN QREST).

Table A-1. Null Value Codes in QREST Software

Flag	Description
AI	Insufficient data (cannot calculate)
AL	Voided by operator
AN	Machine malfunction
AS	Poor quality assurance results
AT	Calibration
AV	Power failure
AX	Precision check
AY	Zero span
AZ	QC audit
BA	Maintenance or routine repairs
BF	Precision/zero/span
BL	QA audit
BK	Site computer/logger down
BN	Sample value exceeds media limits
BR	Sample value below acceptable range
DA	Aberrant data/corrupt files

Table A.2 summarizes the validation process steps from Level 1 verification to the QA Manager/Level 3 oversight report to Tribal management staff. Null codes are first entered by the Air Quality Specialist, or at Level 1, and via QREST may be changed or commented on by higher level reviewers. All levels of reviewers above Level 1 will use the Level 2 validation functions in QREST. The majority of validation actions are recorded in a Level 1 validation report, developed for QREST users, to be completed by the Air Quality Specialist. The final product of QA reviews is a QA oversight report completed by the QA manager for the monitoring project, submitted to the Environmental Director, Air Quality Specialist, and other staff in Administration as appropriate (see Section 4.1, The Role of the Environmental Office).

Printouts of the QA oversight report, and the tabs of the (excel workbook) Level 1 report, are appended in this SOP, as a demonstration of their content. The content reflects the first quarter of data to which use of the reports was applied.

Figure A.1. Is an illustrated overview of the Level 1 validation process. When the Level 1 process is complete, the process for beginning the QA oversight report can begin. Note- because an intermediary Level 2 reviewer may be performing steps as well as the QA Manager (Level 3 in this case), it's noted that the Level 2 actions are included in the bulk Level 1 process, as the Air Quality Specialist must review the outcome of this activity.

An example set of Level 1 report pages made by the Air Quality Specialist, and the QA oversight report made by the QA Manager, are below in Appendix B.

Figure A.1. Level 1 (Site Operator) Data Validation Process

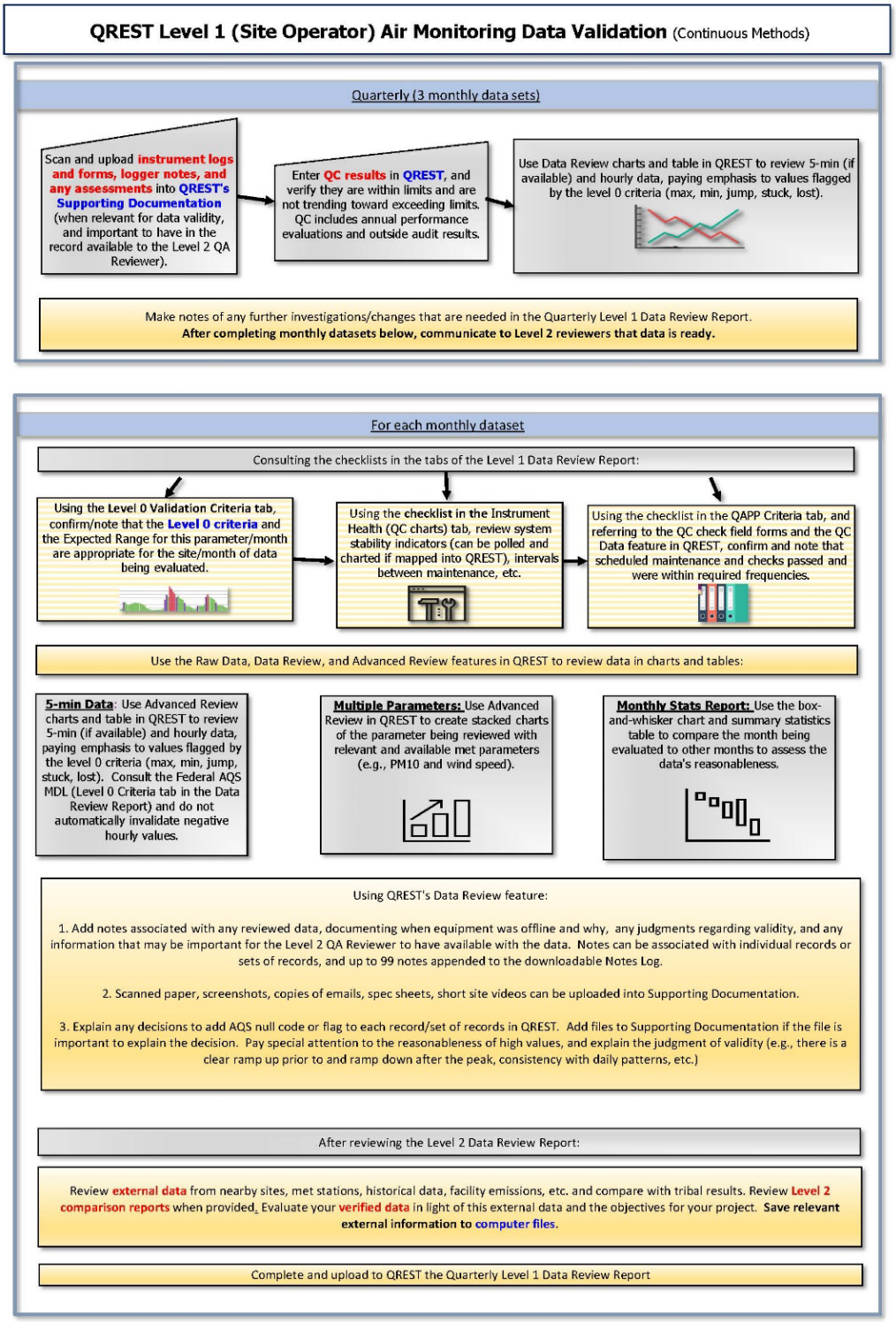


Table A.2. Order of Review in QA Oversight

Review Step	Basis	Location Recorded (Documentation)	Validation Level	Example
Verify Table 14-series items	Maintenance schedule, Instrument displays, automated alerts, QC check schedule & results, QREST flags (Level 0)	QC check forms, instrument logbook, logger notes, QREST reviewer notes	1	Clock is right for timestamp
Review monthly datasets for completion, assign codes for missing data	QREST flags (Level 0)	QREST reviewer notes, instrument logbook	1	Power outage caused missing records, find and assign AI code
Verify automated (Level 0) coding on records including expected range of values	Instrument displays, automated alerts	Codes in records, QREST reviewer notes	1	Identify if codes are needed for repeating records, lost records are coded at Level 0
Identify and code non-ambient records/values	DASC tool calcs, QREST flags (Level 0), maintenance schedule	QREST reviewer notes, instrument logbook	1	Find, code records representing service & maintenance
Investigate and verify unusual ambient records	Instrument logbook, meteorology data, other instrument logbooks and data, data from other monitors	Charts, reports, wind roses for internal use and for Level 2/3 reviewers	1, 2	Compare unusual values against wind and temperature records
Complete the Level 1 report (excel workbook)	All listed, documents uploaded to QREST	Level 1 Report, QREST supporting documents	1	NA
Verify documentation supports Level 1 verification and codes	Documents uploaded in QREST	QREST reviewer notes, Level 2 report	2	Upload the most recent quarter's QC check forms
Verify data is appropriate for The Tribe's use	QREST monthly datasets, EPA QA Documents, QAPP	QREST reviewer notes, Level 2 report	2	NA
Compare with other monitoring stations in the area, including expected range for ozone	QREST monthly datasets	QREST reviewer notes, Level 2 report, correspondence with Level 1	2	Compare spikes or maxima with GBUAPCD monitoring station data
Check validated datasets against FEM requirements and MQOs	EPA Documentation, QAPP	QA oversight report	3 (2)	Any changes in Method, instrument firmware
Review audit report for the time interval of data	Audit report (annually)	QA oversight report	3 (2)	NA
Review QC check field forms and supporting documentation, including correct number of QC checks	Documents uploaded in QREST, Level 1 report	QA oversight report	3 (2)	NA
Perform a correctness check on one set of field form entries	QC check forms	QA oversight report	3 (2)	Bulb intensities are sufficient
Evaluate completeness and null codes	QREST monthly datasets, QREST reviewer notes, Level 1 report	QA oversight report	3 (2)	Annual maintenance over > 75% of a day
Evaluate any suspect data identified by Level 1 or 2 reviewer	QREST reviewer notes, Level 2 report	QA oversight report	3 (2)	deviations in DASC tool calc trends

Review Step	Basis	Location Recorded (Documentation)	Validation Level	Example
Complete QA oversight report	All listed	Email to management staff, QREST supporting documents	3 (2)	NA

AQS Submission of hourly concentration data was initiated in 2005 using the Manual Validation software, and currently is performed using the QREST software (in the event QREST is not available, the logger file may be used instead).

The procedures below outline the entire process of preparing data for submittal, and submitting to AQS.

1. SCHEDULE
   AQS submissions for each quarter are to be completed within 90 days of the end of that quarter. Determination of QC check results must be completed MONTHLY for the prior month. Offsets in dates of checks run, which are biweekly, and end/beginning of the month will result in some extra time needed to complete the prior month after the month changes.

2. PREPARATION – MONTHLY VALIDATION
   Preparation for validating monthly datasets in QREST involves qualifying the automated QC check results. This can be done using data from either, or both, QREST and the logger. The data reviewer may opt for one of the following methods, defaulting to QREST for level 2 validation.

   METHOD 1: QREST
   a) Locate relevant maintenance logs and field forms, and the DASC calcs, and if needed the QC schedule in the instrument timer menu.
   b) Export operator logs from XTerm and move to operator logs folder for viewing or printing.
   c) Follow the steps a - d for "3. MANUAL VALIDATION IN QREST" below.
   d) Differing from step e below, use the drop-down arrow for the monthly ozone dataset for "Advanced Selection".
   e) In the "Data Type" field menu, select "5 MINUTE", check the date range, and continue.
   f) When the dataset chart displays, locate the scheduled QC checks values (spikes) paying attention to the frequency- **e.g., 2 biweekly schedules running offset 1 week is 1 check/week.**
   g) Lasso the non-ambient value bars in the chart to zoom, and to locate the exact records, hover over the bars in the chart, or locate them in the table below the chart.
   h) Open the EPA DASC tool, adapted as *O3 DASC (year).xls*. Enter the date of the QC check in column A.
   i) Enter the (stable) results for all calibration levels in the corresponding tabs of the DASC tool, in ppb. Each level is programmed in the T703U calibrator to run for sufficient 5-minute consecutive periods to provide a stable value, and the run time can be increased in the instrument programming if desired.

   METHOD 2: LOGGER DATA MASTER
   a) Follow steps a through e in Method 1
   b) Export stored data from data logger using XTerm; rename the ssp.txt file, copy in working folder, move original to XTerm original raw data folder.
   c) Import the working data file into XTerm data master worksheet.
   d) Identify records during a check (50Val ≠ 0.0000, 51Val ≠ 99000, or 51Qual = M, R, S, T, or G), occurring 2 weeks apart, for both SPZ and SPN checks. Determine that for each level, the

measured and ideal concentrations are within the acceptance criteria published by EPA in the validation template, see Tables 14-, i.e., calculate the % difference between measured and ideal, including- if necessary- conversion from O3 V to O3 ppm. (*Also see LEADS Quality Control Systems documentation: Calibration Sequences* in regard to levels: *"A level consists of a set concentration from the… calibrator introduced into a monitor for a set number of 5-min average updates. Each level is assigned a letter code (M, R, S, T, or G) by the datalogger… A set number of 5-min updates (usually 3 in each level are allowed for instrument stabilization."*) Refer to the tables in Element 14.

METHOD 3: LOGGER DATA PARTIAL

a) Follow steps a through e in Method 1, but use the ssp_5min_diaog.txt file instead of the ssp.txt
b) Identify records during a check (CalStat_5minVal ≠ 99000, or CalCon_5minQual = M, R, S, T, or G), occurring 2 weeks apart, for both SPZ and SPN checks. For the determination described in Method 1, use the EPA DASC tool, adapted as *O3 DASC tool(year).xls.*
c) Enter the date of the check in column A.
d) Enter the results for all levels except G, using the stable values in the CalCon_5minVal and O3ppb_minVal columns, into the DASC tool columns as notated, in ppm.

3. MANUAL VALIDATION IN QREST *(For hourly data. Do once viewing 5-minute data is complete)*
   a) For details on using the manual validation software, a comprehensive user guide is available at https://www.qrest.net/Home/Help/#Quality-Control.
   b) Open in a web browser (Chrome) www.QREST.net. Log in to access the dashboard. (The above link is accessed by the "?" or Help button in the lower left of the screen).
   c) Using the left sidebar, choose Air Data, and in the dropdowns, Data Review. **NOTE:** ITEP has created comprehensive SOPs (pictorial step charts) instructing how to set up automatic validation, and perform first level validation. Currently the SOPs are available and are stored at https://www.dropbox.com/sh/zi76ar48gickf3m/AAAxWwrO_azXo_aSABw7Pg2Ba?dl=0 These may be revised further as of January 2021.
   d) If, when a monthly dataset is complete, 100% of possible records have not been collected, a button to "fill missing with LOST qualifier" should display, but if otherwise and if needed, import the missing data using the Manual Import page. This is used to configure templates and column mapping for imported data, and to enter data rows for import.
   e) Manual validation for all parameters is completed one pollutant at a time, in monthly sets. Select a month from the dropdowns, and all data parameters will display.
   f) Select one month's data for relevant pollutant. Note any differences in UTC and PST. Data will display in graph form and each 1-hour record. Validation is performed on 1-hour data.
   g) Review data, expanding graph scale and referring to maintenance records as needed. Find any records which aren't "AQS ready" or have QREST flags and assign null value codes to those first. ("AQS ready" means that either a numeric value has been received, or a Null Qualifier has been applied to the hourly record, as per QREST Help documentation.)
   h) Add null value codes (see Table A-1 above) to records where needed based on logbooks, forms etc., either individually or in manageable batches. Null value codes append the numeric value in the dataset (though in the end AQS file will replace it) and are for records where the numeric value represent Table A-1 selected condition and considered invalid because of the flagged condition. The qualifier codes in QREST are for exceptional events and are thus far not used for Bishop Tribe station data. IMPORTANT: Refer to the DASC tool entries, based on the 5-minute data review, for exact hour periods for QC checks- NOTE that the 1-point precision check may not be visible in the hourly data chart, though the span/zero likely is visible.

i) Validate hourly data, adding short validator notes to log or to describe issues with the instruments, until all non-ambient values (values not qualified for ambient measurements) are appended with coding. (Note date of validation and any issues in instrument logbook.) When checking the data against the instrument QC Checks and logs, and for automatically assigned flags, threshold exceedances and stuck values, select Level 1 complete. When checking the data against other systemic elements such as other datasets, other instrument logs, audit reports, calendars, etc., (for consistency) select Level 2 complete (for example, as an outside data reviewer looking at the Bishop Tribe data). Data sets can be completed in modules of a parameter per month. Completion status is displayed for each dataset. An additional validation level above 1 is required for completion and preparation for AQS submittal.

j) This task may be used to satisfy Element 19c Data Transmittal: For a monthly dataset, use the Review drop down arrow for Advanced Selection, and select 5-minute data. Lasso a selection of data in the chart in the review page, and load the corresponding records in the file described in Preparation, Method 3 above (ssp_5min_diaog.txt). Accounting for the timestamp conversion, verify that the records match to 1 decimal place.

4. AQS SUBMISSION
   a) Data are submitted via the website https://enservices.epa.gov/login.aspx. Instructions are contained in the notebook labeled AQS Submission Tutorial.
   b) Once at the website, log on using the default domain
   c) Go to My Services and select NGNProd2
   d) Browse for the file you want to submit, enter AQS user ID, select Bishop Paiute Tribe-EMO as the screening group, and select flat file type. If the data have been thoroughly reviewed during the manual validation process, it is appropriate to select post as the final step and do not stop on error. Send the data. Make a note in the AQS logbook.
   e) Go to Activity Status to verify data processing. When complete, click on transaction ID to download and view reports. E-mail will automatically be sent to the user address provided.
   f) Review and save reports in the AQS Reports directory, adding information on the date of submission in the format mm.dd.yy
   g) Log off ENServices.
   h) Log on to AQS via the website https://aqs.epa.gov/aqs/
   i) Retrieve the AMP350 raw data report, save, print and add to binder with TrEx graphs for the parameters just submitted.
   j) Log off AQS.

Analysis

The web pages in QREST which can be used for analysis are the *Monthly Summary*, *Monthly Statistics Report,* and the *Annual Summary*. HySplit may be used for back trajectories to investigate unusual concentrations. The EPA RETIGO tool for sensor data can be used for comparison with another instrument data in wind roses. Monthly summaries (included in monthly reports to TEPA in warm weather or months with elevated ozone levels), diurnal visualizations, and other manipulations are available in VDV.

SOP 2 - INSTRUMENT MAINTENANCE AND CALIBRATION

Starting in FY21 (October 2021), values from 49i regular checks are recorded in digitized versions of the field forms. The digital forms are excel forms, which allow data pages of key operational indicators to be generated as the user inputs data into a form. A paper form can be used as back up in the event the digital form cannot be used.

Digital forms are treated with the same level of security and back up as paper forms, though they are backed up digitally more frequently (weekly) than paper forms are backed up by scanning. They are printed monthly to add to the printed field form records. Only the credentialed operator may access the digital forms. The order of access and back up ensures that only the working versions of the form will be used for original data entry (on a laptop) in the field, and backed up to the dedicated computer in the Air Program Office, which is then copied to computers on the tribe's main network for regular back up.

Printouts of the digital forms are appended in this SOP, as a demonstration of their content. Current data is included where necessary in order to populate the charts.

Field forms cover service and maintenance according to the following schedule:

BIANNUAL
- 703 Dry Air Pump diaphragm- replace and leak check
- Charcoal scrubber- replace
- Sample line – replace all
- 49i Adjust lamp output

ANNUAL
- Sample line – clean fittings/loop/inlet, replace if needed
- 49i pump- swap and rebuild if needed
- 703 and 49i Bench, inside case, absorption tubes- clean
- 49i Case fan- check/replacement
- 49i Capillaries – clean or replace
- Thermostat temp - check/calibrate
- Equipment audit (third party, NOT on BPT field forms)

Notes: 703 leak check removed, see log & FY17 notes. 49i scrubber check moved to biannual; as per Thermo (2017) replace ~3 years; test not recommended.

QUARTERLY
- 49i bulb intensity check
- 49i Leak test*

MONTHLY
- 703 and 49i Record display values including flows
- 49i PM filter change

MONTHLY CHECK - BISHOP PAIUTE OZONE MONITORING STATION - THERMO 49i SN 6307193020

Date	10/12/2022	Time (PST)	15:09	Operator	ER		
Shelter Temp (°C)	74	Adjust thermostat if not within 2°C of range 20°-30°C					
Alarms?	none						
From the ALARMS menu	Current		Minimum		Maximum		Acceptable Alarm Range*
O_3 Lamp Temp	68	°C	60	°C 60	80	°C 80	65-75°C
Lamp Temp	53.2	°C	50	°C 50	60	°C 60	50-60°C
Bench Temp	35.3	°C	15	°C 15	40	°C 40	5-50°C
Pressure	637.4	mmHg	200	200 mmHg	1000	1000 mmHg	200-1,000 mmHg
Flow A	0.59	LPM	0.4	0.4 LPM	1.4	1.4 LPM	0.4-1.6 LPM
Flow B	0.591	LPM	0.4	0.4 LPM	1.4	1.4 LPM	0.4-1.6 LPM
Intensity A	86901	Hz	45000	45000 Hz	150000	150000 Hz	45,000-150,000 Hz goal: 100,000 Hz clean cell or incr. lamp output if below 65,000 Hz
Intensity B	117218	Hz	45000	45000 Hz	150000	1/1/2011	45,000-150,000 Hz goal: 100,000 Hz clean cell or incr. lamp output if below 65,000 Hz

Put instrument in "p" mode and replace particulate filter

* Acceptable alarm ranges are from the Thermo Model 49i instruction manual.

Enter data in shaded cells
Place cursor/highlight on cell with operator's initials (light red)
Go to 49i monthly data worksheet and place cursor on first cell of row you want data to appear on.
Type ctrl-a, data should be copied from this form to the data sheet.

Check data sheet to be sure data copied correctly.

Again place cursor on op's initials
type ctrl-b to clear sheet (ER: Don't do on laptop)

QUARTERLY CHECK - BISHOP PAIUTE OZONE MONITORING STATION - THERMO 49i SN 6307193020

Note: Set the instrument logger channel to "p" mode before performing the Intensity Check; Reset when done

From the main Menu go to Instrument Controls, then Service, turn Service "on" using the select key.
Press the Menu key twice to see the Service Menu, Go to Service again, then select Intensity Check. Leak test when done.

Date	8/3/2022	Time(PST)	13:08	Op.	ER

Intensity Check

	Intensity		Noise		
Intensity A Reference	87974	Hz	1.4	Hz	Noise should be below 4.0 Hz after 20 seconds
Intensity A Sample	87923	Hz	1.8	Hz	Noise should be below 4.0 Hz after 20 seconds
Intensity B Reference	118873	Hz	2.0	Hz	Noise should be below 4.0 Hz after 20 seconds
Intensity B Sample	118842	Hz	2.3	Hz	Noise should be below 4.0 Hz after 20 seconds *

Leak Check

	Time		Actual	
Flow A	30.0	sec	0.025	LPM
Flow B	30.0	sec	0.018	LPM

Comments:

Enter data into shaded cells on form.
highlight the op initials cell in this sheet and the first column of row for new data in the data sheet
ctrl-d will copy data to the data sheet
check data sheet
highlight the op initials cell in this sheet
ctrl-e will clear the sheet

ANNUAL MAINTENANCE - BISHOP PAIUTE OZONE MONITORING STATION - THERMO 49i SN 6307193020

	Date	Comments
Sample line - clean junctions, replace if needed	6/7/2022	replaced after partial replacement in April
Pump swap 49i	6/6/2022	replaced pump
Clean - bench, absorption tubes, inside case	6/6/2022	
Clean or replace fan	6/6/2022	cleaned
Check/clean capillaries	6/6/2022	replaced with new
Shelter temperature adjust	6/6/2022	
Rebuild spare pump		

Enter data into form.
highlight the first date cell in this sheet and the first column of row for new data in the data sheet
ctrl-f will copy data to the data sheet
check data sheet
highlight the first date cell in this sheet
ctrl-g will clear the sheet

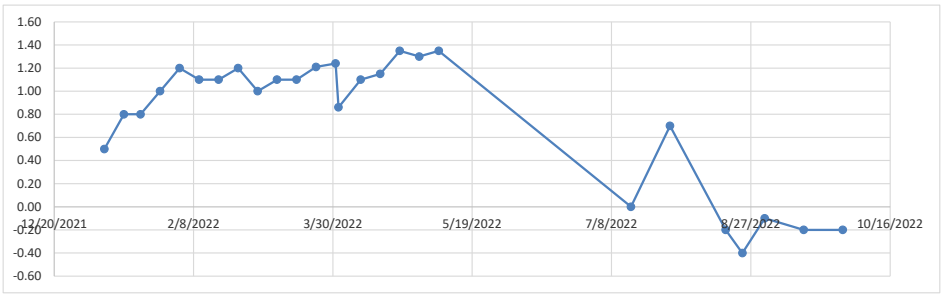
BIANNUAL MAINTENANCE - BISHOP PAIUTE OZONE MONITORING STATION - THERMO 49i SN 6307193020

	YEAR	Comments	DUE YEAR
Replace dry air pump diaphragm 703U, leak check	22	6/6/2022	24
Replace charcoal scrubbers	22	4/1/2022	24
Replace sample line	22	6/7/2022	24
Adjust lamp output	21	6/23/2021 adjusted	23

Enter data into form.
highlight the first date cell in this sheet and the first column of row for new data in the data sheet
ctrl-j will copy data to the data sheet
check data sheet
highlight the first date cell in this sheet
ctrl-k will clear the sheet

ZEROS

1/8/2021	0.74
1/10/2021	0.86
1/22/2021	0.85
1/24/2021	0.88
2/5/2021	0.97
2/7/2021	0.80
2/19/2021	1.04
2/21/2021	0.99
3/2/2021	1.05
3/5/2021	0.97
3/7/2021	0.99
3/19/2021	0.95
3/21/2021	1.01
4/30/2021	1.01
5/2/2021	1.04
5/14/2021	0.93
5/16/2021	0.89
5/28/2021	0.90
5/30/2021	0.98
6/4/2021	0.67
6/11/2021	0.60
6/13/2021	0.80
7/16/2021	0.90
7/23/2021	1.18
7/30/2021	1.00
8/6/2021	1.00
8/13/2021	1.10
8/20/2021	1.10
8/27/2021	1.10
9/3/2021	1.20
9/10/2021	1.10
9/17/2021	1.20
9/24/2021	1.20
10/1/2021	1.20
10/8/2021	1.40
10/15/2021	1.30
10/22/2021	1.40
10/29/2021	1.30
11/5/2021	1.00
11/12/2021	1.10
11/19/2021	1.00
11/26/2021	0.90
12/3/2021	1.00
12/10/2021	1.50
12/17/2021	1.00
12/24/2021	0.90
12/31/2021	0.90
1/7/2022	0.50
1/14/2022	0.80
1/20/2022	0.80
1/27/2022	1.00
2/3/2022	1.20
2/10/2022	1.10
2/17/2022	1.10
2/24/2022	1.20
3/3/2022	1.00
3/10/2022	1.10
3/17/2022	1.10
3/24/2022	1.21
3/31/2022	1.24
4/1/2022	0.86
4/9/2022	1.10
4/16/2022	1.15
4/23/2022	1.35
4/30/2022	1.30
5/7/2022	1.35
7/15/2022	0.00
7/29/2022	0.70
8/18/2022	-0.20
8/24/2022	-0.40
9/1/2022	-0.10
9/15/2022	-0.20
9/29/2022	-0.20



O_3 Assessments

	Pollutant type: O_3							CV_{ub} (%)		Bias (%)	
	Meas Val (Y)	Audit Val (X)	d (Eqn. 1)	25th Percentile	d^2	|d|	$\|d\|^2$				
1/10/2021	74.63	90	-17.078	-12.853	291.650	17.078	291.650				
1/24/2021	74.53	90	-17.189	th Percen	295.458	17.189	295.458	n	S_d	S_{d2}	$\Sigma\|d\|$
2/7/2021	71.9	90	-20.111	3.844	404.457	20.111	404.457	40	10.808	201.315	343.300
2/21/2021	68.73	90	-23.633		558.534	23.633	558.534	n-1	Σd	Σd^2	$\Sigma\|d\|^2$
3/2/2021	68.29	90	-24.122		581.882	24.122	581.882	39	-185.061	5411.799	5411.799
3/7/2021	67.46	90	-25.044		627.224	25.044	627.224				
3/21/2021	68.52	90	-23.867		569.618	23.867	569.618				
5/2/2021	70.4	90	-21.778		474.272	21.778	474.272				
5/16/2021	71.42	90	-20.644		426.193	20.644	426.193				
5/30/2021	72.23	90	-19.744		389.843	19.744	389.843				
6/4/2021	93.27	90	3.633		13.201	3.633	13.201				
6/13/2021	94.2	90	4.667		21.778	4.667	21.778				
7/16/2021	94.73	90	5.256		27.621	5.256	27.621				
7/30/2021	95	90	5.556		30.864	5.556	30.864				
8/13/2021	95.2	90	5.778		33.383	5.778	33.383				
8/20/2021	95	90	5.556		30.864	5.556	30.864				
9/10/2021	93.8	90	4.222		17.827	4.222	17.827				
9/24/2021	94.4	90	4.889		23.901	4.889	23.901				
10/8/2021	93.4	90	3.778		14.272	3.778	14.272				
10/22/2021	93.1	90	3.444		11.864	3.444	11.864				
11/5/2021	91.4	90	1.556		2.420	1.556	2.420				
11/19/2021	91.6	90	1.778		3.160	1.778	3.160				
12/17/2021	89.1	90	-1.000		1.000	1.000	1.000				
12/31/2021	88.6	90	-1.556		2.420	1.556	2.420				
1/14/2022	87	90	-3.333		11.111	3.333	11.111				
1/27/2022	84.1	90	-6.556		42.975	6.556	42.975				
2/10/2022	81.5	90	-9.444		89.198	9.444	89.198				
2/24/2022	81.6	90	-9.333		87.111	9.333	87.111				
3/10/2022	79.7	90	-11.444		130.975	11.444	130.975				
3/24/2022	82.64	90	-8.178		66.876	8.178	66.876				
4/1/2022	92.09	90	2.322		5.393	2.322	5.393				
4/16/2022	94.29	90	4.767		22.721	4.767	22.721				
4/30/2022	93.64	90	4.044		16.358	4.044	16.358				
7/15/2022	81	80	1.250		1.563	1.250	1.563				
7/15/2022	51	50	2.000		4.000	2.000	4.000				
7/15/2022	27	25	8.000		64.000	8.000	64.000				
8/18/2022	82.3	80	2.875		8.266	2.875	8.266				
8/24/2022	81.1	80	1.375		1.891	1.375	1.891				
9/7/2022	81.9	80	2.375		5.641	2.375	5.641				
9/21/2022	79.9	80	-0.125		0.016	0.125	0.016				

"AB" (Eqn 4)	"AS" (Eqn 5)
8.583	7.951

Bias (%) (Eqn 3)	Both Signs Positive
10.7	FALSE
Signed Bias (%)	Both Signs Negative
+/-10.7	FALSE

CV (%) (Eqn 2)
12.71

Upper Probability Limit	Lower Probability Limit
16.56	-25.81

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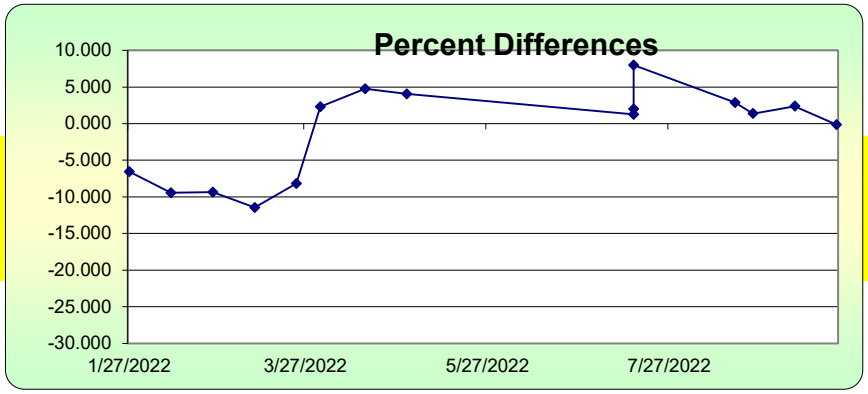

O_3 Assessments

			Pollutant type: O_3					CV_{ub} (%)			Bias (%)	
	Meas Val (Y)	Audit Val (X)	d (Eqn. 1)	h Percen	d^2	|d|	$\|d\|^2$					
1/8/2021	315.06	400	-21.235	-21.824	450.925	21.235	450.925					
1/10/2021	311.67	400	-22.083	h Percen	487.637	22.083	487.637	n	S_d	S_{d2}	$\sum\|d\|$	"AB" (Eqn 4)
1/22/2021	313.74	400	-21.565	0.629	465.049	21.565	465.049	75	12.441	363.074	806.950	10.759
1/24/2021	308.86	400	-22.785		519.156	22.785	519.156	n-1	$\sum d$	$\sum d^2$	$\sum\|d\|^2$	"AS" (Eqn 5)
2/5/2021	293.23	400	-26.693		712.490	26.693	712.490	74	-763.286	19222.040	19222.040	11.934
2/7/2021	295.74	400	-26.065		679.384	26.065	679.384					
2/19/2021	284.39	400	-28.903		835.355	28.903	835.355				Bias (%) (Eqn 3)	Both Signs Positive
2/21/2021	277.91	400	-30.523		931.623	30.523	931.623				13.05	FALSE
3/2/2021	272.53	400	-31.868		1015.538	31.868	1015.538	CV (%) (Eqn 2)			Signed Bias (%)	Both Signs Negative
3/2/2021	205.52	300	-31.493		991.830	31.493	991.830	13.95			+/-13.05	FALSE
3/2/2021	141.44	200	-29.280		857.318	29.280	857.318					
3/5/2021	273.65	400	-31.588		997.770	31.588	997.770	Upper Probability Limit			Lower Probability Limit	
3/7/2021	274.29	400	-31.428		987.688	31.428	987.688	14.21			-34.56	
3/19/2021	282.09	400	-29.478		868.923	29.478	868.923					
3/21/2021	276.72	400	-30.820		949.872	30.820	949.872					
4/30/2021	271.64	400	-32.090		1029.768	32.090	1029.768					
5/2/2021	281.36	400	-29.660		879.716	29.660	879.716					
5/14/2021	281.86	400	-29.535		872.316	29.535	872.316					
5/16/2021	290.56	400	-27.360		748.570	27.360	748.570					
5/28/2021	287.2	400	-28.200		795.240	28.200	795.240					
5/30/2021	294.82	400	-26.295		691.427	26.295	691.427					
6/4/2021	393.14	400	-1.715		2.941	1.715	2.941					
6/11/2021	403.5	400	0.875		0.766	0.875	0.766					
6/13/2021	403.2	400	0.800		0.640	0.800	0.640					
7/16/2021	403.51	400	0.877		0.770	0.877	0.770					
7/23/2021	404.36	400	1.090		1.188	1.090	1.188					
7/30/2021	404.8	400	1.200		1.440	1.200	1.440					
8/6/2021	403.7	400	0.925		0.856	0.925	0.856					
8/13/2021	404.3	400	1.075		1.156	1.075	1.156					
8/20/2021	405.3	400	1.325		1.756	1.325	1.756					
8/27/2021	405.1	400	1.275		1.626	1.275	1.626					
9/3/2021	401.3	400	0.325		0.106	0.325	0.106					
9/20/2021	403.3	400	0.825		0.681	0.825	0.681					
9/17/2021	403.7	400	0.925		0.856	0.925	0.856					
9/24/2021	403	400	0.750		0.563	0.750	0.563					
10/1/2021	402.5	400	0.625		0.391	0.625	0.391					
10/8/2021	399.8	400	-0.050		0.002	0.050	0.002					
10/15/2021	396.9	400	-0.775		0.601	0.775	0.601					
10/22/2021	396.4	400	-0.900		0.810	0.900	0.810					
10/29/2021	399.5	400	-0.125		0.016	0.125	0.016					
11/5/2021	392.5	400	-1.875		3.516	1.875	3.516					
11/12/2021	393.4	400	-1.650		2.723	1.650	2.723					
11/19/2021	391.2	400	-2.200		4.840	2.200	4.840					
11/26/2021	386.2	400	-3.450		11.903	3.450	11.903					
12/3/2021	385.4	400	-3.650		13.323	3.650	13.323					
12/3/2021	90.4	90	0.444		0.198	0.444	0.198					
12/10/2021	385.2	400	-3.700		13.690	3.700	13.690					
12/17/2021	380.5	400	-4.875		23.766	4.875	23.766					
12/24/2021	380.4	400	-4.900		24.010	4.900	24.010					
12/31/2021	376.4	400	-5.900		34.810	5.900	34.810					
1/7/2022	373.7	400	-6.575		43.231	6.575	43.231					
1/14/2022	371.5	400	-7.125		50.766	7.125	50.766					
1/20/2022	361.7	400	-9.575		91.681	9.575	91.681					
2/3/2022	351.1	400	-12.225		149.451	12.225	149.451					
2/10/2022	343	400	-14.250		203.063	14.250	203.063					
2/17/2022	348.3	400	-12.925		167.056	12.925	167.056					
2/24/2022	338.8	400	-15.300		234.090	15.300	234.090					
3/3/2022	358	400	-10.500		110.250	10.500	110.250					
3/10/2022	323.4	400	-19.150		366.723	19.150	366.723					
3/17/2022	325.1	400	-18.725		350.626	18.725	350.626					
3/24/2022	340.69	400	-14.828		219.855	14.828	219.855					
3/31/2022	329.77	400	-17.558		308.266	17.558	308.266					
4/1/2022	396.5	400	-0.875		0.766	0.875	0.766					
4/9/2022	402.53	400	0.632		0.400	0.632	0.400					
4/16/2022	403.29	400	0.823		0.677	0.823	0.677					
4/23/2022	404.19	400	1.048		1.097	1.048	1.097					
4/30/2022	401.88	400	0.470		0.221	0.470	0.221					
5/7/2022	404.09	400	1.022		1.046	1.022	1.046					
7/15/2022	402	400	0.500		0.250	0.500	0.250					
7/29/2022	404.8	400	1.200		1.440	1.200	1.440					
8/18/2022	406.1	400	1.525		2.326	1.525	2.326					
8/24/2022	403.1	400	0.775		0.601	0.775	0.601					
9/1/2022	402	400	0.500		0.250	0.500	0.250					
9/15/2022	399.1	400	-0.225		0.051	0.225	0.051					
9/29/2022	397.7	400	-0.575		0.331	0.575	0.331					

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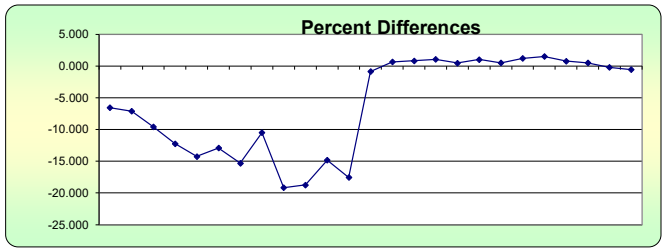
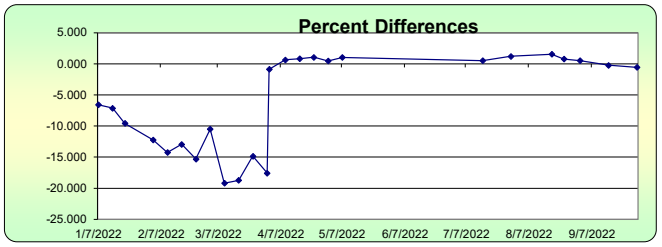
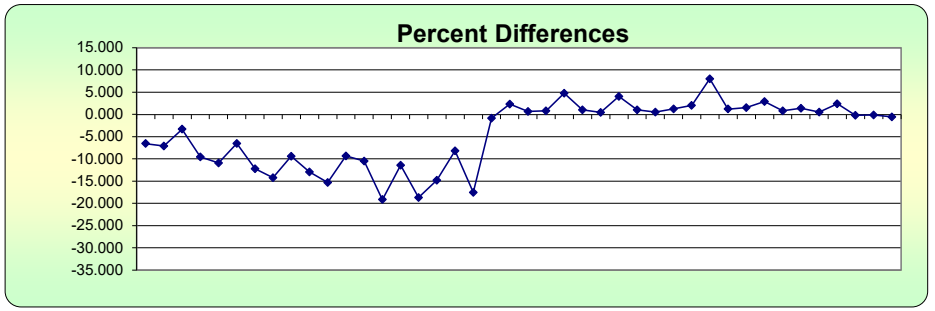


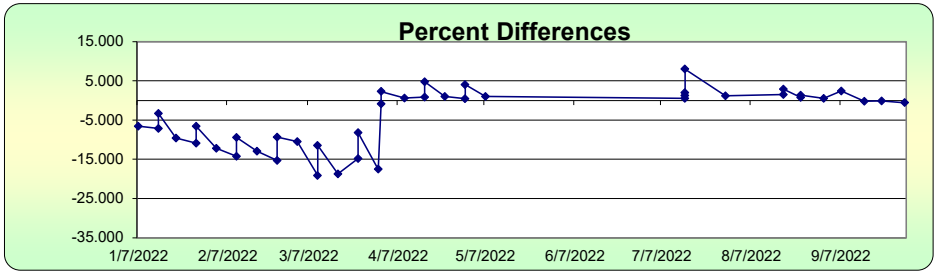


O_3 Assessments

			Pollutant type: O_3					CV_{ub} (%)				Bias (%)	
DATE	Meas Val (Y)	Audit Val (X)	d (Eqn. 1)	h Percen	d^2	|d|	$\|d\|^2$						
1/8/2021	315.06	400	-21.235	-19.044	450.925	21.235	450.925						
1/10/2021	311.67	400	-22.083	h Percen	487.637	22.083	487.637	n	S_d	S_{d2}	$\Sigma\|d\|$	"AB" (Eqn 4)	
1/10/2021	74.63	90	-17.078	0.998	291.650	17.078	291.650	118	12.035	317.785	1162.354	9.850	
1/22/2021	313.74	400	-21.565		465.049	21.565	465.049	n-1	Σd	Σd^2	$\Sigma\|d\|^2$	"AS" (Eqn 5)	
1/24/2021	308.86	400	-22.785		519.156	22.785	519.156	117	-959.868	24753.932	24753.932	10.664	
1/24/2021	74.53	90	-17.189		295.458	17.189	295.458						
2/5/2021	293.23	400	-26.693		712.490	26.693	712.490				Bias (%) (Eqn 3)	Both Signs Positive	
2/7/2021	295.74	400	-26.065		679.384	26.065	679.384				11.48	FALSE	
2/7/2021	71.9	90	-20.111		404.457	20.111	404.457	CV (%) (Eqn 2)			Signed Bias (%)	Both Signs Negative	
2/19/2021	284.39	400	-28.903		835.355	28.903	835.355	13.16			+/-11.48	FALSE	
2/21/2021	277.91	400	-30.523		931.623	30.523	931.623						
2/21/2021	68.73	90	-23.633		558.534	23.633	558.534	Upper Probability Limit			Lower Probability Limit		
3/2/2021	272.53	400	-31.868		1015.538	31.868	1015.538	15.45			-31.72		
3/2/2021	205.52	300	-31.493		991.830	31.493	991.830						
3/2/2021	141.44	200	-29.280		857.318	29.280	857.318						
3/2/2021	68.29	90	-24.122		581.882	24.122	581.882	Return to Main Menu			Print Worksheet		
3/5/2021	273.65	400	-31.588		997.770	31.588	997.770						
3/7/2021	274.29	400	-31.428		987.688	31.428	987.688						
3/7/2021	67.46	90	-25.044		627.224	25.044	627.224						
3/19/2021	282.09	400	-29.478		868.923	29.478	868.923						
3/21/2021	276.72	400	-30.820		949.872	30.820	949.872						
3/21/2021	68.52	90	-23.867		569.618	23.867	569.618						
4/30/2021	271.64	400	-32.090		1029.768	32.090	1029.768						
5/2/2021	281.36	400	-29.660		879.716	29.660	879.716						
5/2/2021	70.4	90	-21.778		474.272	21.778	474.272						
5/14/2021	281.86	400	-29.535		872.316	29.535	872.316						
5/16/2021	290.56	400	-27.360		748.570	27.360	748.570						
5/16/2021	71.42	90	-20.644		426.193	20.644	426.193						
5/28/2021	287.2	400	-28.200		795.240	28.200	795.240						
5/30/2021	294.82	400	-26.295		691.427	26.295	691.427						
5/30/2021	72.23	90	-19.744		389.843	19.744	389.843						
6/4/2021	393.14	400	-1.715		2.941	1.715	2.941						
6/4/2021	297.34	300	-0.887		0.786	0.887	0.786						
6/4/2021	200.65	200	0.325		0.106	0.325	0.106						
6/4/2021	93.27	90	3.633		13.201	3.633	13.201						
6/11/2021	403.5	400	0.875		0.766	0.875	0.766						
6/13/2021	403.2	400	0.800		0.640	0.800	0.640						
6/13/2021	94.2	90	4.667		21.778	4.667	21.778						
7/16/2021	403.51	400	0.877		0.770	0.877	0.770						
7/16/2021	94.73	90	5.256		27.621	5.256	27.621						
7/23/2021	404.36	400	1.090		1.188	1.090	1.188						
7/30/2021	404.8	400	1.200		1.440	1.200	1.440						
7/30/2021	95	90	5.556		30.864	5.556	30.864						
8/6/2021	403.7	400	0.925		0.856	0.925	0.856						
8/13/2021	404.3	400	1.075		1.156	1.075	1.156						
8/13/2021	95.2	90	5.778		33.383	5.778	33.383						
8/20/2021	405.3	400	1.325		1.756	1.325	1.756						
8/27/2021	405.1	400	1.275		1.626	1.275	1.626						
8/27/2021	95	90	5.556		30.864	5.556	30.864						
9/3/2021	401.3	400	0.325		0.106	0.325	0.106						
9/10/2021	403.3	400	0.825		0.681	0.825	0.681						
9/10/2021	93.8	90	4.222		17.827	4.222	17.827						
9/17/2021	403.7	400	0.925		0.856	0.925	0.856						
9/24/2021	403	400	0.750		0.563	0.750	0.563						
9/24/2021	94.4	90	4.889		23.901	4.889	23.901						
10/1/2021	402.5	400	0.625		0.391	0.625	0.391						
10/8/2021	399.8	400	-0.050		0.002	0.050	0.002						

10/8/2021	93.4	90	3.778	14.272	3.778	14.272
10/15/2021	396.9	400	-0.775	0.601	0.775	0.601
10/22/2021	396.4	400	-0.900	0.810	0.900	0.810
10/22/2021	93.1	90	3.444	11.864	3.444	11.864
10/29/2021	399.5	400	-0.125	0.016	0.125	0.016
11/5/2021	392.5	400	-1.875	3.516	1.875	3.516
11/5/2021	91.4	90	1.556	2.420	1.556	2.420
11/12/2021	393.4	400	-1.650	2.723	1.650	2.723
11/19/2021	391.2	400	-2.200	4.840	2.200	4.840
11/19/2021	91.6	90	1.778	3.160	1.778	3.160
11/26/2021	386.2	400	-3.450	11.903	3.450	11.903
12/3/2021	385.4	400	-3.650	13.323	3.650	13.323
12/3/2021	90.4	90	0.444	0.198	0.444	0.198
12/10/2021	385.2	400	-3.700	13.690	3.700	13.690
12/17/2021	380.5	400	-4.875	23.766	4.875	23.766
12/17/2021	89.1	90	-1.000	1.000	1.000	1.000
12/24/2021	380.4	400	-4.900	24.010	4.900	24.010
12/31/2021	376.4	400	-5.900	34.810	5.900	34.810
12/31/2021	88.6	90	-1.556	2.420	1.556	2.420
1/7/2022	373.7	400	-6.575	43.231	6.575	43.231
1/14/2022	371.5	400	-7.125	50.766	7.125	50.766
1/14/2022	87	90	-3.333	11.111	3.333	11.111
1/20/2022	361.7	400	-9.575	91.681	9.575	91.681
1/27/2022	356.3	400	-10.925	119.356	10.925	119.356
1/27/2022	84.1	90	-6.556	42.975	6.556	42.975
2/3/2022	351.1	400	-12.225	149.451	12.225	149.451
2/10/2022	343	400	-14.250	203.063	14.250	203.063
2/10/2022	81.5	90	-9.444	89.198	9.444	89.198
2/17/2022	348.3	400	-12.925	167.056	12.925	167.056
2/24/2022	338.8	400	-15.300	234.090	15.300	234.090
2/24/2022	81.6	90	-9.333	87.111	9.333	87.111
3/3/2022	358	400	-10.500	110.250	10.500	110.250
3/10/2022	323.4	400	-19.150	366.723	19.150	366.723
3/10/2022	79.7	90	-11.444	130.975	11.444	130.975
3/17/2022	325.1	400	-18.725	350.626	18.725	350.626
3/24/2022	340.69	400	-14.828	219.855	14.828	219.855
3/24/2022	82.64	90	-8.178	66.876	8.178	66.876
3/31/2022	329.77	400	-17.558	308.266	17.558	308.266
4/1/2022	396.5	400	-0.875	0.766	0.875	0.766
4/1/2022	92.06	90	2.289	5.239	2.289	5.239
4/9/2022	402.53	400	0.632	0.400	0.632	0.400
4/16/2022	403.29	400	0.823	0.677	0.823	0.677
4/16/2022	94.29	90	4.767	22.721	4.767	22.721
4/23/2022	404.19	400	1.048	1.097	1.048	1.097
4/30/2022	401.88	400	0.470	0.221	0.470	0.221
4/30/2022	93.64	90	4.044	16.358	4.044	16.358
5/7/2022	404.09	400	1.022	1.046	1.022	1.046
7/15/2022	402	400	0.500	0.250	0.500	0.250
7/15/2022	81	80	1.250	1.563	1.250	1.563
7/15/2022	51	50	2.000	4.000	2.000	4.000
7/15/2022	27	25	8.000	64.000	8.000	64.000
7/29/2022	404.8	400	1.200	1.440	1.200	1.440
8/18/2022	406.1	400	1.525	2.326	1.525	2.326
8/18/2022	82.3	80	2.875	8.266	2.875	8.266
8/24/2022	403.1	400	0.775	0.601	0.775	0.601
8/24/2022	81.1	80	1.375	1.891	1.375	1.891
9/1/2022	402	400	0.500	0.250	0.500	0.250
9/7/2022	81.9	80	2.375	5.641	2.375	5.641
9/15/2022	399.1	400	-0.225	0.051	0.225	0.051
9/21/2022	79.9	80	-0.125	0.016	0.125	0.016
9/29/2022	397.7	400	-0.575	0.331	0.575	0.331





Multipoint Verification/Calibration Assessment

Acceptance Criteria: all points within B4% of best fit straight

Percentage Acceptance Value	2%
Calibration Scale (ppb)	400
Point Difference Acceptance Value (ppb)	1.5
Slope Acceptance Criteria	.95 - 1.05

Only values on sheet that can be changed are in colors	Orange
	Green

Instructions

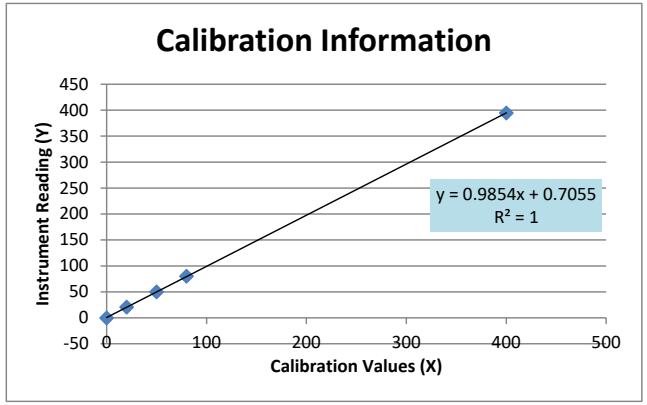
1) Select the calibration scale. This does not need to the the FEM approved scale of the instrument (e.g., 500 ppb or 1000 ppb) in B5. It should be the high cal value. The point difference acceptance value in field B6 will be calculated for the values entered in B4 and B5.
2) Place calibration values (X) in orange cells in row 17
3) Enter the conc. values (Y) from the instrument in the green fields. The worksheet allows for 7 values per conc., but you can place only one row of data into the worksheet and delete the data in the other rows.
4) the remainder of the worksheet should automatically calculate the results.
5) Any point result > the point difference acceptance criteria in B6 will turn the boxes and font in rows 28 red. Any percent difference > than value in B4 will turn the boxes and font in rows 29 red.
6) The percent difference estimates are measured using the best fit conc. values and the average of the instrument values for each conc.
7) Any slope greater than the slope acceptance criteria in B7 will turn Slope Box red

	Zero Concentration	Concentration 2	Concentration 3	Concentration 4	Concentration 5
Calibrator Value (X) (ppb)	0	20	50	80	400
Instrument Values (Y) (ppb)	-0.3	20.8	50.1	80.2	394.7
Average	-0.30	20.80	50.10	80.20	394.70

Best Fit Concentration	**20.41**	**49.98**	**79.54**	**394.87**
Point Difference (Best fit - Average)	**0.39**	**0.12**	**0.66**	**0.17**
Percent Difference (Best fit Conc vs. Avg Y values)	1.89%	0.25%	0.83%	-0.04%

r	slope (m_i)	intcpt (I_i)	lin reg
1.0000	0.9854	0.7055	0.988

X	Y
0	-0.30
20	20.80
50	50.10
80	80.20
400	394.70



APPENDIX B. EXAMPLE QA OVERSIGHT REPORT

QA Oversight and Data Validation Report for Bishop Paiute Tribe Air Quality Monitoring Station
July 2022 – September 2022

Name of reviewer: Scott E. Weaver, conducting QA Oversight for BPT Air Quality Program.
Report Date: 8/18/2022

List of Supporting Information:

1. QREST – Quality Review & Exchange System for Tribes, including uploads, monthly datasets, statistics report. www.qrest.net
2. BPT Data dashboard at Vista Data Vision: https://vdv.tbsys.com (BPTAIR, BPTAIR395)
3. BPT current QAPPs & SOPs for PM10, PM2.5, Ozone, Meteorological Monitoring. http://www.bishoptribeemo.com/library.htm
4. Air Now, AirNow Tech Navigator website, http://www.airnowtech.org/data/, and GBUAPCD validated data https://www.gbuapcd.org/cgi-bin/downloadData
5. *Attached:* Quarterly Level 0-2 Validation Report (excel workbook) from Air Quality Specialist Emma Ruppell, with validation criteria, plots, and notes.
6. *Attached:* Quarterly comparison report with Big Pine Paiute Tribe Air Quality Monitoring Station (by Cindy Duriscoe).

SUMMARY OF ANY DATA RECOMMENDED FOR INVALIDATION

Data identified (dates)	Null code recommended	Reason	Supporting info (reference)
no data recommended for invalidation	NA	NA	NA

QC Oversight Report:

1) **Review of QC forms**
   Spanning 7/1/22 through 9/30/22.

   At least one calculated field in each QC sheet was hand-calculated to verify the result, and no errors were found.

   All QC checks were completed, with documentation by the BPT Air Quality Specialist where needed.

   All monthly PM2.5 checks, biweekly PM10 flow checks, and weekly Ozone calibrations were performed except Ozone calibrations were only performed 7/15, 7/29, 8/18, and 8/24 before automated weekly calibrations began on 9/1.

   All limits match the most recent EPA validation template (QA Handbook) and the most recent BPT QAPP.

   The dates and times of these QC checks were checked in QREST.

2) **Null Value Codes**
   The selected sample data was appropriately and consistently coded and when appropriate, the Level 1 reviewer had already added the **null value codes** for these hours in the parameter data.

   The data in QREST that was already correctly invalidated is listed in the Quarterly Level 0-2 Validation Report.

3) **Data Review**
   Data for the period 7/1/22 through 9/30/22 are complete.

Data selection dates reviewed:

Quarterly, Semi-Annual, Annual maintenance and calibrations are up to date. The TEOM/PM10 Annual and Semi-Annual maintenance and calibrations were performed in September, 2022. The PM2.5 Semi-Annual maintenance was performed in July and the Ozone Semi-Annual maintenance was performed in June.

Meteorological, PM10, PM2.5 and Ozone monitors were audited by a third party on 11/19/21. No problems were noted. The next audit is scheduled for the fall of 2022.

Additionally, a Meteorological calibration/check was performed on 4/20/22 with Cindy Duriscoe, the Big Pine Paiute Tribe Air Quality Specialist. No problems were noted.

Scott Weaver
scotteweaver@yahoo.com
760-920-2966

Bishop Paiute Air Level 1 Report page 1: Explanation

This template report is to be completed by the Level 1 Reviewer, who may often be the Site Operator. Regulatory programs require an independent data review by a Level 2 Reviewer. This is intended to be comprehensive enough for regulatory programs, but flexible so that only those components that apply and are useful can be used.

The Level 1 Reviewer identifies all rows that are particularly important for the Level 2 Reviewer to review by adding their initials and datetime to Column B in the Level 1 Report. These include all values assigned AQS null codes. This form automatically identifies these rows for the Level 2 Reviewer in Column A with amber boxes for the Level 2 Reviewer. (The Level 2 Review Report template will be a new sheet in this file, and includes links to AirNowTech for wind roses and relevant sites which may provide corroborating data for unusual values at this site.)

The Level 1 Report includes the following components:

1. Title, with Datetime Interval and Parameter
2. Summary of Reviewed and Invalidated Records (with line # in this report and overall completeness so that this report can be quickly understood)
3. Review Criteria, including Expected Range and QAPP Criteria (Checklist in QAPP Criteria tab)
4. Summary Hourly Plots (QC charts)
5. Specific Intervals Reviewed and Invalidation Decisions, with each interval including:
    a. identification of interval and reason data are being scrutinized
    b. questions from the reviewer, followed by the response from the Site Operator or the Level 1 Reviewer
    c. screenshot the user can insert if that may be useful for the next reviewer
    d. five minute values if available and useful for understanding the data
    e. validation/invalidation decision and null codes
6. Reviewer Notes

See color coding rubric below.

grey indicates preset language for that section, such as a title or description of section
yellow indicates this is a text box and any info is hand-entered by the reviewer
peach indicates that this is a selection box in QREST, with the user selecting parameter or datetime.
amber indicates a field that must be completed for final validation
when formatting is copied, blue and white indicates QREST downloaded records

Bishop Paiute Air L1 report page 3: Level 0 AQS Site Tribal ID 549

Meteorological Codes and Level 0 Criteria:

Par Code	Par Name	Method Code	POC	Duration Code	Collect Freq Code	Collection Unit Code	Alert Min	Alert Max	Alert Amt Change	Alert Stuck Count
61103	Wind Speed - Resultant	020	1	1		012	0			3
61106	Std Dev Hz Wind Direction	020	1	1		014	0	360		3
62201	Relative Humidity	011	1	1		019	0	100	20	3
88101	PM2.5 - Local Conditions	236	1	1	1	105	-10	500	100	3
62101	Outdoor Temperature	040	1	1		015	-60	150	180	3
44201	Ozone	047	1	1		008	0	100	20	3
64101	Barometric pressure	011	1	1		016	0	900	20	3
61104	Wind Direction - Resultant	020	1	1		014				3
88500	PM2.5 Total Atmospheric	761	3	1		105	-10	5000	30	3
63301	Solar radiation	011	1	1		025	0			3
62107	Indoor Temperature	040	1	1		015	-60	150	180	3
65102	Rain/melt precipitation	014	1	1		021	0	0.03	0	
81102	PM10 Total 0-10um STP	079	4	1		001	-10	500	100	3
61101	Wind Speed - Scalar	050	1	1		012	0	80		3
61105	Peak Wind Gust	020	1	1		012	0			3
62103	Dew Point	020	1	1		015	-40		120	3

requires Level 2 approval | now last edited by:

Level 1 Quarterly Data Review of Jul - Sep 2022 **ozone**

Summary:

10/26/2022 **Completeness after Level 1 validation=** 97% *(see monthly stats report in QREST)*

	#Invalidated	AQS null code	description	link to interval	Resolved by Level 1?
10/26/2022	19	AI	missing data	Interval 1	y
10/26/2022	3	AT	calibration	Interval 2	y
10/26/2022	26	BA	maintenance/repairs	Interval 3	y
10/26/2022	2	BC	multi point calibration	Interval 4	y
10/26/2022	15	BF (or AX)	precision/zero/span (or precision)	Interval 5	y
10/26/2022	1	BK	site computer/logger down	Interval 6	y
10/26/2022	8	DA	aberrant data	Interval 7	y

Specific Interval Review Criteria:

Expected range during:	7/1/2022 0:00	expected minimum =	1.475	ppb
	9/30/2022 23:00	expected maximum =	72.56	ppb
Element 19 c Transmittal check	8/14/2022 0:00	8/18/2022 0:00	0	records not matching

Documentation that the Site Operator has verified that the maintenance on the equipment and any equipment health issues have been resolved for this time period *(see the QAPP criteria checklist in this file)* **and that the QAPP Review Criteria have been met for this time period** *(see also the QC charts tab and QAPP Criteria tab)*

	DOCUMENT TYPE	LOCATION	NOTES	LEVEL	INITIAL
10/25/2022	**Operator logs**	Uploaded to QREST	site operator logs extracted from datalogger	1	
	Logbook scans/field forms	Uploaded to QREST	images or scans of instrument logbook	1	
10/25/2022	**QC check results**	Uploaded to QREST	DASC tool or other	1	ER
10/25/2022	**TEPA report summaries**	TEPA summay tab	maintenance summaries	1	ER
	Level 2 reports/assessments	Uploaded to QREST	comparison with Big Pine Paiute air station	2	

Review of Specific Data Values:

Interval 1:

	datetime start	datetime end	description
10/26/2022			missing records

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
QREST Notes on this parameter and interval:
10/26/2022 records missing from polled data (or missing in logger file)

Level 1 decision on records nulled:

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	7/14, 7/28-29		AI	19

Interval 2:

	datetime start	datetime end	description
10/26/2022			multipoint calibration

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
QREST Notes on this parameter and interval:
10/26/2022 5 point calibration, run from internal timer

Level 1 decision on records nulled:

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	9/20/2022		AT	3

Interval 3:

	datetime start	datetime end	description
10/26/2022			maintenance/repairs

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
QREST Notes on this parameter and interval:
10/26/2022 Calibrator sequences and internal timer testing. Restarts needed for clock to work. Changed clock settings.

Level 1 decision on records nulled:

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	8/23/2022	8/24/2022	BA	26

Interval 4:

	datetime start	datetime end	description
10/26/2022			calibration

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
10/26/2022 ***Level 1 decision on records nulled*** 5 point calibration- run by DY remotely via numaview

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	7/15/2022		BC	2

Interval 5:

	datetime start	datetime end	description
10/26/2022			QC checks

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
10/26/2022 ***Level 1 decision on records nulled*** checks in july and aug were manual; automated checks via calibrator internal timer started 9/1

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	7/29, 8/18, 8/24, 9/1, 9/7, 9/21, 9/29		BF (or AX)	15

Interval 6:

	datetime start	datetime end	description
10/26/2022			site computer/logger down

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
10/26/2022 ***Level 1 decision on records nulled*** computer swap

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	8/29/2022		BK	1

Interval 7:

	datetime start	datetime end	description
10/26/2022			corrupt data file

Question for Site Operator?
Answer from Site Operator:

5-minute Values for this Time Interval ->
10/26/2022 ***Level 1 decision on records nulled:***

	datetime start	datetime end	AQS Null Code Assigned	# Records Null Coded
10/26/2022	9/28/2022		DA	8

10/26/2022 ***Reviewer Notes:***

Graphs are available directly in QREST data review. Dates of null coded records are provided, dates of interval analyzed are entered if different. There are multiple codes in QREST for ozone QC checks, they may be used in the data interchangeably thus far (this quarter). **Checks in july and aug were manual; automated checks via calibrator internal timer started 9/1 Checks are biweekly span & zero, and biweekly 1-point precision check (80ppb)**

DATA_DTTM	NOTES	NOTE_D	USER	AI
7/14/2022 9:00:00 A	missing from logger file. ER	8/23/2022	Emma Ruppell	
7/14/2022 9:00:00 A	Checked against maintenance records. Checked for internal consistency. ER	8/23/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BC
7/15/2022 9:00:00 A	Calibration. ER	8/23/2022	Emma Ruppell	
7/15/2022 9:00:00 A	Checked against maintenance records. Checked for internal consistency. ER	8/23/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	AI
7/28/2022 1:00:00 F	missing from logger file. ER	8/23/2022	Emma Ruppell	
7/28/2022 1:00:00 F	Checked against maintenance records. Checked for internal consistency. ER	8/23/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
7/29/2022 12:00:00	QC checks. ER	8/23/2022	Emma Ruppell	
7/29/2022 12:00:00	Checked against maintenance records. Checked for internal consistency. ER	8/23/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	DA
8/9/2022 10:00:00 A	analyzer signal test (unplugged)	10/26/202	Emma Ruppell	
8/9/2022 10:00:00 A	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
8/9/2022 10:00:00 A	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
8/18/2022 3:00:00 F	QC checks	10/26/202	Emma Ruppell	
8/18/2022 3:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
8/18/2022 3:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BA
8/23/2022 12:00:00	calibrator internal levels testing, programming, &system restarts. ER	10/26/202	Emma Ruppell	
8/23/2022 12:00:00	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
8/23/2022 12:00:00	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
8/24/2022 9:00:00 A	QC checks	10/26/202	Emma Ruppell	
8/24/2022 9:00:00 A	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
8/24/2022 9:00:00 A	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BK
8/29/2022 1:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
8/29/2022 1:00:00 F	computer swap. ER	10/3/2022	Emma Ruppell	
8/29/2022 1:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
9/1/2022 9:00:00 PI	QC checks (1st automated with new calibrator)	10/26/202	Emma Ruppell	
9/1/2022 9:00:00 PI	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	AX
9/7/2022 9:00:00 PI	QC precision check	10/26/202	Emma Ruppell	
9/7/2022 9:00:00 PI	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
9/15/2022 8:00:00 F	QC checks	10/26/202	Emma Ruppell	
9/15/2022 8:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	AT
9/20/2022 9:00:00 F	5 point calibration	10/26/202	Emma Ruppell	
9/20/2022 9:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	AX
9/21/2022 9:00:00 F	QC precision check	10/26/202	Emma Ruppell	
9/21/2022 9:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	DA
9/28/2022 9:00:00 A	corrupt data files	10/26/202	Emma Ruppell	
9/28/2022 9:00:00 A	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	
DATA_DTTM	NOTES	NOTE_D	USER	BF
9/29/2022 8:00:00 F	QC checks	10/26/202	Emma Ruppell	
9/29/2022 8:00:00 F	Checked against maintenance records, checked for internal consistency. ER	10/3/2022	Emma Ruppell	

APPENDIX C. AUDIT REPORT, STANDARD CERTIFICATION, AND AUDIT SOP

Standard Operating Procedure

SOP-TB-10.1-O3

Ozone Instrument Audit Procedures

Effective Date: November 10, 2020

Written by:

David Yoho

1.1 Introduction

Ozone audits are used to validate ambient ozone instruments that collect and analyze air data at air monitoring stations. Ozone, which is a ubiquitous gas in the atmosphere, is generally created by the reaction of free oxygen free radical and diatomic oxygen. The process starts with Nitrogen Dioxide (NO_2). NO_2 goes through a process known as photolysis where one of the oxygen molecules disassociates and becomes a free radical, $O(^3P)$. The free radical then reacts with diatomic oxygen, O_2, which is abundant in the atmosphere. Please see the following chemical reactions:

$$NO_2 + h\nu \rightarrow NO + O(^3P)\ ,\ \lambda<400\ nm$$
$$O(^3P) + O_2 \rightarrow O_3$$

Ozone usually forms in the late morning hours of the day, usually after rush hour traffic. The NO_2, which is a byproduct from mobile and stationary combustion sources, is available for photolysis. Once the sun rises in the morning, ozone will form until all of the NO_2 is exhausted.

Because ozone is highly reactive, it cannot be stored in a cylinder; it must be generated using an UV lamp. United States Environmental Protection Agency's (U.S. EPA's) offices throughout the United States operate and maintain a set of ozone instrument that are known as Standard Reference Photometers (SRPs). The SRPs reside in the EPA laboratories throughout the US. The SRPs are intercompared amongst themselves, thus creating a "set " of standards. It is the responsibility of the EPA to maintain and intercompare these standards. These levels of standards are known as the Level 1.

The level 1 SRPs are made available to State, Local, Tribal and private standards, which are known as the Level II standards. Usually, the Level II standard remains in the laboratory until it needs recertification and travels (or a surrogate standard) travels to the Level I standard and is intercompared to the Level I. Once the Level II standard has been verified and certified, the T&B ozone instruments can be tested and verified. The T&B system Level II standard is housed in the Valencia Office and maintained by our staff. The instruments that go into the field to calibrate the on-site instruments are known as Level III standards or commonly known as the Transfer Standards (TSs). The ozone TS is used to generate known amounts of ozone in the United States Environmental Protection Agency's (U.S. EPA's) required audit ranges. This ozone concentration is then introduced into the station's inlet probe. The response of the air monitoring station's ozone analyzer to this concentration is then compared to the actual ozone levels measured and a percent difference is calculated.

The T&B Systems Teledyne API 700EU (s/n 83) dilution calibrator with internal photometer is used as the transfer standard (TS) to perform performance audits. The audit is performed by transporting the portable ozone TS to the site and connecting it to the ozone analyzer to be audited (host analyzer). The ozone output from the TS is then compared to the results obtained during the audit from the host analyzer. From the analysis of these results, a percent difference is calculated and an audit report issued.

Please note that T&B's Level II standard is certified annually by the EPA Region 9 Laboratory in San Francisco, California.

This procedure addresses the actual set-up and operation of the portable ozone TS.

1.2 General Operating Procedures

Ozone concentrations are generated by a stable ozone generator and verified by a certified TS. The zero air sources are either a custom-built scrubbing system (that uses PuraFil and activated charcoal columns to remove sulfur, oxides of nitrogen and ozone species) or a commercial unit (that uses an oxidation/reduction of NO species to NO_2 and activated charcoal to remove the same interference). The analyzers are challenged with specific concentrations of span gas as follows (in ppm):

Table 1. Ozone Audit Levels

Audit level	Ozone
Level Zero	0.000
Level 1	0.02 – 0.05
Level 2	0.06 – 0.10
Level 3	0.11 – 0.20
Level 4	0.21 – 0.31
Level 5	0.31-0.90
Level 6 (optional)	0.000

The points are based on U.S. EPA requirements as presented in the revision of 0 CFR Part 58 Appendix A, Section 3.2.2.

1.3 Audit Equipment

- Teledyne API 700EU (s/n 83).
- Teflon tubing, Teflon or stainless steel fittings and ferrules.
- Zero air generator as described above or compressed ultra-pure air zero air cylinder.

1.4 Audit Procedures

- The first step to the ozone audit is establish a location where the ozone TS can be set up and operated. Usually a flat surface, such as a bench top or even mounting it in a rack.
- Turn on the TS and allow the photometer to warm up. This usually takes between 15 to 30 minutes.
- At this time, notify the station operator that you are ready to begin the audit. Have the station operator bring the data acquisition system (DAS) channel into calibration mode.

- Attach a Teflon line from the station manifold to the input of the audit TS. If the station has an ozone generator that is built into the on-site calibration system, begin by having the station operator initiate a zero air point. Allow both the on-site ozone instrument and TS sample this air in the manifold for a minimum of 5 minutes. After both TS and ozone instrument have stabilized, record the reading from the TS and request that the station operator read the average ozone value from the DAS.
- Increase the ozone concentration to the first audit level as described in Table 1. Allow both the on-site ozone instrument and TS sample this air in the manifold for a minimum of 10 minutes. After both TS and ozone instrument have stabilized, record the reading from the TS and request that the station operator read the average ozone value from the DAS.
- Increase the ozone concentration to the second audit level as described in Table 1. Allow both the on-site ozone instrument and TS to sample this air in the manifold for a minimum of 10 minutes. After both TS and ozone instrument have stabilized, record the reading from the TS and request that the station operator read the average ozone value from the DAS.
- Repeat this process until 5 audit points have been generated and sampled.
- At this time, a final zero point can be generated, however, this is optional.

1.5 Audit Calculations and Criteria

Since a certified TS is utilized, the average of the readings is the audit value. The readings from the DAS are used for the onsite values. The difference should not be greater than 10% of any reading. In addition, the slope, intercept and correlation coefficient for the data set should be calculated.
See audit form below for more information.

AUDIT RECORD

OZONE

T&B Systems
25570 Rye Cyn. Rd, Unit J
Valencia, CA 91355
(661) 294-1103

Date:		Site Name:	
Start:		Operator:	
Finish:		Project:	
Auditor:			
Witness:			
Analyzer make:		Model:	
Serial No.:		Filter replaced:	
Sample flow:		Cell A:	
Slope:		Cell B:	
Offset:		Last calibrated:	
Range:			

O_3 Audit Point	*PPM Input (X)*	*PPM Chart (Y)*	*PPM DAS (Y)*	*PPM Diff (%)*
1	0.000		0.001	--
2	0.036		0.036	*0.0*
3	0.085		0.086	*1.2*
4	0.184		0.185	*0.5*

Linear Regression: (Y=PPM Site, X=PPM Input)

	DAS	*Chart*
Slope:	1.0021	
Intercept:	0.001	
Correlation:	1.0000	

Comments: There were no problems noted.

Audit Equipment	*Make*	*Model*	*ID*	*Certification Date*
Dilution System:	Teledyne API	700EU	83	12/6/19
Ozone Standard:	Teledyne API	700EU	83	09/03/19
Zero Air System:	Teledyne API	701	2427	NA

Ozone Transfer Standard			
Sample Freq:	NA	Cell Temperature:	NA deg C
Control Freq:	NA	Ambient Pressure:	NA "Hg
Span Setting:	NA	Certification Slope:	0.9904
		Certification Intercept:	0.0010 ppm

1.6 Calibration and Certification

T&B SYSTEMS, INC.

OZONE TRANSFER STANDARD CERTIFICATION

LEVEL 2		**LEVEL 3**	
PHOTOMETER		**STANDARD**	
Manufacture:	API	Manufacture:	API
Model:	401	Model:	M700EU
S/N:	143	S/N:	83
O3 Measure:	3938	Photometer Slope:	0.985
O3 Reference:	3941	Photometer Intercept:	-1.8
Slope:	0.971	Zero Air Source:	CSI
Offset:	1.3	Photo Meas:	4329.7
Sample Flow:	830 cc/min	Photo Ref:	4332.1
Total Flow:	5.0 lpm		
Ozone Source:	Internal	Location:	Valencia Lab
Zero Air Source:	Charcoal	Ambient pressure:	NA
EPA certification to SRP 36:	9/25/18	Lab Temperature:	NA

O_3 Input Point	LEVEL 2 (X) PHOTOMETER (PPB)	LEVEL 3 (Y) STANDARD (PPB)	% Diff
1	2.0	0.0	
2	49.4	47.7	-3.4%
3	100.0	99.0	-1.0%
4	200.2	200.0	-0.1%
5	300.0	300.6	0.2%
6	400.0	401.6	0.4%

Slope: 0.9911
Intercept: 2.011
R^2: 1.0000

Certified By: David Yoho Date: September 3, 2019

Comments: Verification

Input Point DATA POINT	0 Pri. "X"	0 Tran. "Y"	50 Pri. "X"	50 Tran. "Y"	100 Pri. "X"	100 Tran. "Y"	200 Pri. "X"	200 Tran. "Y"
1	2	-1	50	46	100	98	201	199
2	2	-1	50	46	100	98	201	199
3	2	-1	50	46	100	98	200	199
4	2	-1	50	47	100	98	200	199
5	2	-1	49	47	100	98	200	199
6	2	-1	49	47	100	98	200	199
7	2	-1	49	47	100	98	200	199
8	2	-1	49	47	100	98	200	199
9	2	-1	49	47	100	98	200	199
10	2	-1	49	47	100	98	200	199
Average	2.0	-1.0	49.4	46.7	100.0	98.0	200.2	199.0
Stan.dev.	0.0	0.0	0.5	0.5	0.0	0.0	0.4	0.0
Difference			47.4	47.7	98.0	99.0	198.2	200.0
Factor								
DATA								
Cell temp.								

Input Point DATA POINT	300 Pri. "X"	300 Tran. "Y"	400 Pri. "X"	400 Tran. "Y"
1	300	300	400	400
2	300	300	400	400
3	300	300	400	400
4	300	300	400	400
5	300	300	400	401
6	300	300	400	401
7	300	299	400	401
8	300	299	400	401
9	300	299	400	401
10	300	299	400	401
Average	300.0	299.6	400.0	400.6
Stan. dev.	0.0	0.5	0.0	0.5
Difference	298.0	300.6	398.0	401.6
Factor				
DATA				
Cell temp.				

Last Six Runs	Date	Slope	Intercept	Correlation	Ave Slope	Ave Intercept (PPB)	Std Dev Slope (≤3.7%)	Std Dev Intercept (≤1.5 PPB)
1	8/7/2017	0.9920	1.2	1.0000				
2	1/15/2018	0.9915	2.0	0.9999				
3	6/4/2018	0.9905	-0.1	1.0000				
4	11/26/2018	0.9885	0.8	1.0000				
5	5/28/2019	0.9887	1.2	1.0000				
6	9/3/2019	0.9911	2.0	1.0000	*0.9904*	*1.2*	*0.1*	*0.8*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX LABORATORY
1337 S. 46TH STREET
BLDG 201
RICHMOND, CA 94804-4698

December 6, 2018

Level 2 Ozone Transfer Standard Verification Report

TO: David Bush
T&B Systems, Inc.

FROM: Andrew Lincoff
USEPA Region 9 Laboratory

Calibration/Verification Standard: SRP 36 (Cell Length = 89.65)

Guest Instrument Owner: **T&B Systems, Inc.**
Guest Instrument Type: **API 401**
Serial Number: **143**
Other ID: **none**

Verification Date: **September 25, 2018**

Verification Status: This ozone transfer standard meets the criteria set by EPA for successful verification.

Regression slopes are 1.00 $\pm$ 0.03, and intercepts are 0 $\pm$ 3 ppb.

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Summary of Results

9/25/2018
API 401, SN 143

Conc. Level	Test 1		Test 2		Test 3	
	SRP 36	Guest Value	SRP 36	Guest Value	SRP 36	Guest Value
1.00	-0.1	1.1	-0.1	0.9	-0.2	0.9
2.00	504.7	500.1	502.6	500.0	501.6	499.6
3.00	452.7	448.8	450.7	448.8	451.0	449.1
4.00	401.3	398.0	398.1	397.9	398.9	397.6
5.00	348.8	346.4	347.2	346.3	348.2	346.9
6.00	296.7	295.4	296.0	295.6	296.6	295.4
7.00	245.3	244.6	244.1	244.4	244.4	244.1
8.00	193.5	193.1	193.2	193.1	193.6	193.0
9.00	141.9	142.0	143.0	142.2	142.5	142.4
10.00	90.1	90.8	91.0	91.3	91.0	91.2
11.00	39.3	39.8	39.2	39.7	39.5	40.1
12.00	0.0	1.1	0.2	1.1	-0.2	0.8
Slope		0.98884		0.99473		0.99410
Intercept		1.42004		0.86504		0.82586

Mean Slope	0.99
Mean Intercept	1.04

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APPENDIX D. INITIAL TESTING FORMS

Photometer Correlation Certificate

TELEDYNE API
Everywhereyoulook

This instrument has been correlated using standards maintained at Teledyne API (9970 Carroll Canyon Road, San Diego, CA 92131, USA), which are traceable to the United States National Institute of Standards and Technology. This correlation was performed to Teledyne API specifications and to the requirements of ISO 9001:2015. Supporting documentation relative to traceability is on file at this office, and is available for examination at Teledyne API upon request.

Correlation of:

Date: 2/24/2022
Serial Number: 382

Model: T703U
Operator: RD

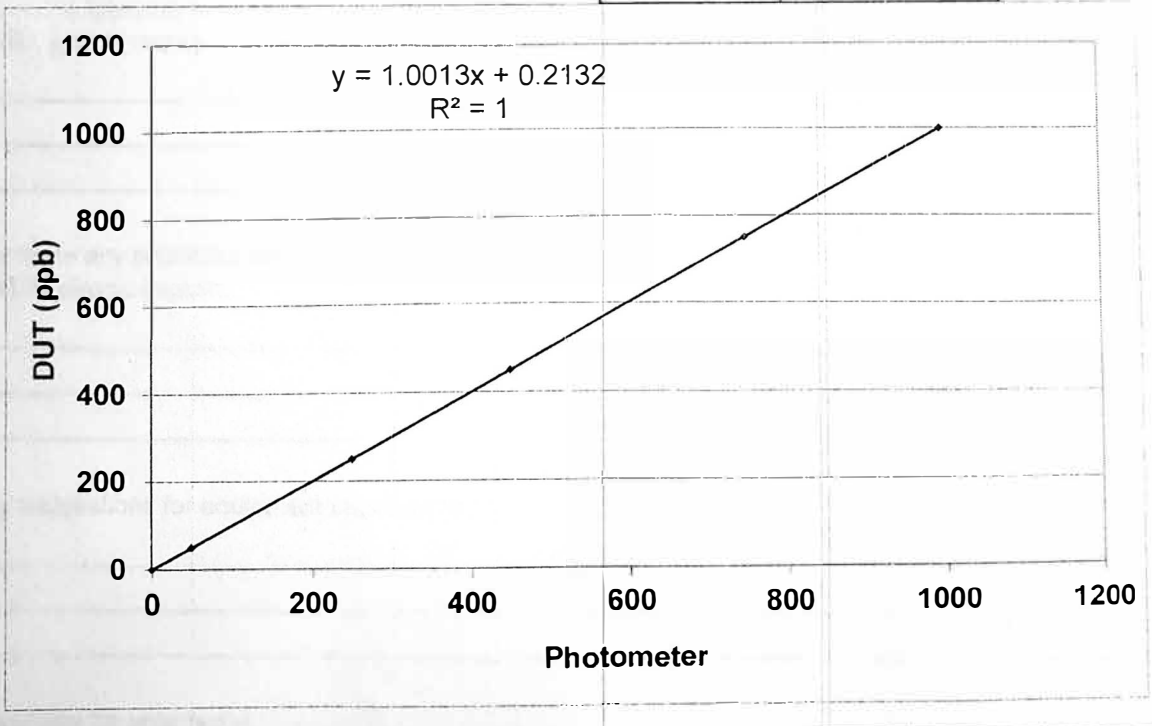
Reference Photometer Info:

Model: T400
Serial Number: 3542
Certification due date: 11/22/2022

Test Points (PPB)	Measurements		Difference (PPB)	Difference (%)
	Photometer	DUT		
0	0.1	0	-0.1	0
50	49.2	50	0.8	1.626
250	249.7	250	0.3	0.120
450	449	450	1	0.223
750	749.2	750	0.8	0.107
1000	998.2	1000	1.8	0.180
			0	NA

DUT = Device under test

Average % Difference	0.45%
Standard Deviation (%)	0.66%



Performed at the following environmental conditions: Temperature: 20C +/- 7C; RH: 20-80%; Pressure: 29.92 in-Hg-A +/- 1

Performed by: RDL Date: 2/24/2022
Test technician

Approved by: D. Hunter Date: 2/25/22
Quality Representative

TELEDYNE
ADVANCED POLLUTION INSTRUMENTATION
Everywhereyoulook

T703U Final Calibrated Test and Validation Data

2/25/22

MODEL:	T703U				
Firmware:	082870000 1.3.19.184	Serial Number:	382		
Date:	2/24/2022	Technician:	RD	SP#:	NO

Parameter	Displayed As	Observed Value	Units	Final Test Process Control Limits at Factory**	Acceptable Limits in Use
ACT O3 Conc [3]	ACT=	450.2	PPB	± 1% of TARG=	± 1% of TARG=
Target O3 Conc [3]	TARG=	450	PPB		
O3 Output Flow [2,3]	OUTPUT FLOW	5.17	LPM	max adj flow > 5 LPM	max adj flow > 5 LPM
Regulator O3 Pressure [3,4]	O3 PRESSURE	7	PSIG	8 ± 1.0 PSIG	8 ± 1.0 PSIG
Regulator Pressure [2,3]	REG PRESSURE	13.2	PSIG	15 ± 2.0 PSIG @ 5LPM	15 ± 2.0 PSIG @ 5LPM
Box Temp	BOX TEMP	27.7	°C	20 - 35 °C	8 - 48 °C
O3 Gen Ref [1,2]	O3 GEN REF	N/A	mVDC	25-600 mV	25-600 mV
O3 Gen Drive [1,2]	O3 GEN DRIVE	800	mVDC	800 mV	800 mV
Ozone Lamp Temp	O3 LAMP TEMP	48	°C	48 ± 0.5 °C	48 ± 0.5 °C
Ozone Flow [3,4]	O3 FLOW	24	cc/min	25 ± 5 cc/min	25 ± 5 cc/min
Ozone Divert Flow [3,4]	O3 DIVERT FLOW	245	cc/min	250 ± 20 cc/min	250 ± 20 cc/min
Ozone Gen Flow [3,4]	O3 GEN FLOW	273	cc/min	275 ± 25 cc/min	275 ± 25 cc/min
Photo Measure [1,2]	PHOTO MEASURE	4528.6	mVDC	4300 - 4700 mV	2500 - 4800 mV
Photo Reference [1,2]	PHOTO REFERENCE	4528.7	mVDC	4300 - 4700 mV	2500 - 4800 mV
Photo Flow [3]	PHOTO FLOW	0.808	LPM	0.720 - 0.880 LPM	0.720 - 0.880 LPM
Photo Lamp Temp	PHOTO LAMP TEMP	58	°C	58 ± 0.5 °C	58 ± 0.5 °C
Photo Sam Press [1,2]	PHOTO SPRESS	28.7	In-Hg-A	27 - 29.9 In-Hg-A	24 - 30 In-Hg-A
Photo Sample Temp	PHOTO STEMP	37.5	°C	28 - 45 °C	28 - 45 °C
Photo Slope	PHOTO SLOPE	0.997	-	1 ± 0.03	1 ± 0.03
Photo Offset	PHOTO OFFSET	0.868	PPB	0 ± 3 PPB	0 ± 3 PPB
Dark Offset	DARK OFFSET	-0.1	mVDC	0 ± 20 mV	0 ± 20 mV

** For good instrument performance, the steadiness of this signal is more important than its absolute value (within the operating range)*

*** These are process control limits, and not specification limits. Items out of range do not imply the unit is out of specification.*

[1] Recorded in Standby Mode. [2] Recorded in Generate Zero mode. [3] Recorded in Generate O3 mode. [4] 703U MACHINE ONLY

Statement of Calibration

The unit identified above has been tested with NIST measuring and test equipment using lot traceable materials. The testing is performed in accordance with ISO 9001-2008 and is traceable to NIST and industry recognized standards.

Configuration and Options

Power Configuration: Voltage:	100 - 120V
Frequency:	60 Hz
Rack Mounts with Slides (20A, 20B)	
Rack Mounts Only (21)	
Drierite Cartridge (91)	
Zero Air Shutoff Valve	Yes
Internal Zero Air Pump	Yes
Strap Carrying Handle (29)	
Multi-drop (62)	
Ethernet (63A, STD T-Series)	Yes
Multi-drop and Ethernet (63C E-Series)	
External Valve Driver (48A, 48B)	
Test Channel Output Voltage	5 VDC
USB COM2 (64A T-Series)	
COM 1 Test Channel Configuration	RS-232
COM 2 Configuration	RS-232

UV Lamp Information

Lamp Origin	UVP - 047760000
Lamp Serial Number	U203741

Additional Information:

TELEDYNE
API
Everywhereyoulook™

9970 Carroll Canyon Road
San Diego, CA 92131

QC Feedback Form

Customer BISHOP PAIUTE Date 5/18/22

Instrument/Model T703U Serial No 382

Phone No 760 784-9308 Fax No

Did the instrument arrive in good condition? YES ✓ NO ___
(If damaged in shipment, please contact the shipper and file a claim.)

Did the instrument arrive on time? YES ✓ NO ___

Was the analyzer configured per your order? ~~—~~ MANUAL YES ___ NO ___
If NO, please explain.

IT HAD OLD FIRMWARE. CONFIRMED BY TAPI STAFF ON 5/18/22.

Does the analyzer perform in accordance with its specifications? YES ___ NO ___
If NO, please explain.

DOES NOT HAVE DASIBI CODING OF MANUAL

Are there any problems with the analyzer? YES ___ NO ___
If YES, please explain.

Any suggestions for equipment improvement?

Thank you for your reply!

Please fax to T-API: +1-858-657-9816
Attn: Quality Department