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QUALITY ASSURANCE PROJECT PLAN

CONTINUOUS MONITORING OF

Ozone (O_3) for the Enforcement of the National Ambient Air Quality Standards

Swinomish Indian Tribal Community,
Department of Environmental Protection,
Air Quality
Version 1
Revision 0

April 2026

Prepared by Kelsey Larson and Sally Vaux

GROUP A: PROJECT MANAGEMENT AND INFORMATION/DATA QUALITY OBJECTIVES

QUALITY ASSURANCE PROJECT PLAN ON THE CONTINUOUS MONITORING OF OZONE FOR THE ENFORCEMENT OF THE NATIONAL AMBIENT AIR QUALITY STANDARDS

Period of Applicability for this Quality Assurance Project Plan (QAPP) starts on the date of the EPA R10 QAM's signature and ends five years after that date or until a new version of the QAPP is approved.

Element 2 - APPROVAL (A2)

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Element 3 - TABLE OF CONTENTS, DOCUMENT FORMAT, AND DOCUMENT CONTROL (A3)

3.1 - Figures

3.2 - Tables

3.3 - Acronyms & Abbreviations

49i – Thermo Environmental Instruments model 49i ozone analyzer
8872 – Agilaire 8872 Site Node
AQ – Air Quality
AQI – Air Quality Index
AQS – EPA Air Quality System
ARL – NOAA Air Resources Laboratory
ASIL – Acceptable Source Impact Level (From Washington State Code)
CARB – California Air Resources Board
CAP – Criteria Air Pollutant
CAS # - Chemical Abstracts Service Registry Number
CFR – Code of Federal Regulations
CV – Coefficient of Variation
DAS – Data Acquisition System
DMP – Data Management Plan
DEP – Department of Environmental Protection
DQI – Data Quality Indicator
DQO – Data Quality Objectives
EPA – Environmental Protection Agency
EPA R10 – EPA Region 10 (WA, OR, ID and AK)
HAP – Hazardous Air Pollutant
HQ – Hazard Quotient
HRRR – High-Resolution Rapid Refresh Model
HYSPLIT – Hybrid Single-Particle Lagrangian Integrated Trajectory
ITEP – Institute for Tribal Environmental Professionals
MDL – Measurement Detection Limit
MGCS – Multi-Gas Calibration System
MQO – Measurement Quality Objective
NEI – EPA National Emission Inventory
NCEP – National Centers for Environmental Prediction
NIST – National Institute of Standards and Technology
NOAA – National Oceanic and Atmospheric Administration
NPAP – National Performance Audit Program
NWCAA – Northwest Clean Air Agency (local WA State air quality agency with jurisdiction in Skagit, Whatcom, and Island counties)
OSHA – Occupational Health and Safety Administration
PQAO – Primary Quality Assurance Organization
ppb – parts per billion (mixing ratio unit)
ppm – parts per million (mixing ratio unit)
QA – Quality Assurance
QA/QC – Quality Assurance & Quality Control
QAM – Quality Assurance Manager
QADR – QA Data Reviewer
QAPP – Quality Assurance Project Plan
QC – Quality Control
RAP – NOAA Rapid Refresh Model
REL – NIOSH Recommended Exposure Limit
SAAP – Swinomish Ambient Air Quality Program
SAQMS – Swinomish Air Quality Monitoring Station
SITC – Swinomish Indian Tribal Community
SMP – Site Management Plan
SOP – Standard Operating Procedure
SRP – EPA Standard Reference Photometer
TAP – Toxic Air Pollutant (used in Washington State law)
TEI – Thermo Environmental Instruments
TSA – Technical Systems Audit
VOC – Volatile Organic Compound
WAC – Washington Code (Washington State regulations)
WQA – Water Quality Analyst
WRF – Weather Research and Forecast
ZAG – Zero Air Generator

Element 4 - PROBLEM BACKGROUND/DEFINITION (A4)

The Swinomish Indian Tribal Community (SITC) is concerned with two aspects of air quality (AQ) on the Swinomish Reservation – adverse human health impacts and cumulative ecological impacts. Tribal members have a higher-than normal-incidence of respiratory diseases such as asthma (Swinomish Climate Change Initiative). The Swinomish Medical Clinic reports that respiratory distress is one of the top three reasons ambulances are called to the Reservation. Additionally, the Swinomish are the People of the Salmon. Fishing and gathering are not only a source of income for many Tribal members, but important cultural and religious practices, in addition to representing an exercise of Treaty-reserved rights. For these reasons, environmental degradation—and impacts to riverine and coastal waters in particular—threatens the Swinomish way of life.

The Swinomish Ambient Air Program (SAAP) was established in 1999 focusing on indoor AQ and monitoring Criteria Air Pollutants (CAPs). In the late 1990s, sulfur dioxide (SO_2), nitrogen dioxide (NO_2 and its precursor nitrogen oxide, NO), and ozone (O_3) were main concerns as the Swinomish Reservation was a non-attainment zone. Of these CAPs, O_3 remains the most likely to result in an exceedance of the National Ambient Air Quality Standards (NAAQS) due to the impacts of climate change. O_3, unlike SO_2 and NO, is not emitted at a source and instead is created in situ from the combination of sunlight, temperature, and NO_x and volatile organic compounds (VOCs) presence.

The objectives of this program are to 1) monitor ambient O_3 concentrations for the enforcement of the NAAQS, 2) create a real-time portal for emergency response staff to make public health decisions based on O_3 concentrations, and 3) provide real-time AQ data to the public to make personal health decisions.

This QAPP describes project methods, refers to EPA-established data quality objectives (DQOs), and defines data quality assurance and control (QA/QC) methods for monitoring O_3 at one Swinomish Air Quality Monitoring Station (SAQMS), SAQMS5 (not built yet; in the Swinomish Village area). Currently the O_3 instrument is at SAQMS1 and will remain there until we can move it to the new station. This Quality Assurance Project Plan (QAPP) was developed to ensure consistent, repeatable results and to improve the reliability and comparability of data collected.

The following section (A4.1) will indicate the relevant health impacts of O_3 on people and the environment. Section A4.2 will outline general sources of O_3 precursors (NO and NO_2 – NO_x and VOCs) on and near Reservation.

4.1 - Health Impacts of O_3

O_3 is a colorless, slightly odorous, reactive (unstable) gas that occurs at ground-level, in the troposphere, in the upper atmosphere, and in the stratosphere. While O_3 occurs naturally in the stratosphere where it protects the Earth from the sun's ultraviolet rays, ground-level and tropospheric O_3 are health and environmental hazards. Due to this, O_3 is classified as a CAP.

O_3 can harm human health and affect vegetation and ecosystems, even at low concentrations. The primary route of entry into the body is inhalation; symptoms generally involve the lungs and include coughing, sore or scratchy throat, shortness of breath, chest pain on deep inhalations, increased number of asthma attacks, and damage to the lungs. The population at greatest risk are children because their lungs are still developing, they are more likely to be active outdoors when O_3 levels are high, and they are more likely to have asthma than adults. The population at next highest risk are the elderly and those with cardio-respiratory diseases like COPD and asthma.

4.2 - Precursors of O_3 (NO_x and VOCs)

O_3 is considered a secondary pollutant (i.e., not directly emitted but produced because of other air pollutants). In everyday life, we know O_3 pollution as "smog" that is prevalent in urban areas worldwide. Smog is a haze produced from photochemical reactions between O_3, VOCs, and NO_x resulting in elevated surface level O_3 and secondary particulate matter with a diameter less than 2.5 microns ($PM_{2.5}$). In this way, the right amount of NO_x and VOCs act as catalysts to produce high and dangerous levels of surface O_3. Human activities that have increased the VOCs and NO_x emitted into the atmosphere include industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents, which then correspond to an increase in O_3 in the right conditions.

O_3 is likely to reach unhealthy levels on hot, sunny days in urban environments where there is the right mix of NO_x and VOCs. This is especially prevalent in locations like Houston, TX where the off-gassing from the petrochemical industry mixes with metropolitan vehicle pollution in the summer to produce O_3 concentrations well over 100 ppb at the surface. In an environment where the NO_x concentration exceeds the VOC concentration (or vice versa), O_3 will be destroyed. Thus, near-source O_3 levels can be titrated and are thus not optimal locations to monitor O_3.

When NO_x from urban and industrial processes is transported into rural areas with organically and industrially produced VOCs, O_3 levels can increasingly impact rural areas. This rural kind of haze impacts the visibility of the natural environment and is regulated by the Regional Haze Rule. Numerous studies have identified O_3 enhancement from transported pollution plumes originating from China reaching the PNW (Jaffe et al., 1999; Liang et al., 2007; Lin et al., 2012). Elevated O_3 concentrations have been observed during even during cold months at a few high elevation locations in the western U.S. due to high levels of local VOC emissions and long-range NO_x transport (Langford et al. 2025).

Thus, to understand O_3 production near Reservation, the 2014, 2017, and 2020 National Emissions Inventory (NEI) emissions of NO_x from facilities are shown in Figure 5-1, 5-2, and 5-3, respectively, and the 2014, 2017, and 2020 NEI emissions of VOCs are shown in Figure 5-4, 5-5, and 5-6, respectively. Emissions of NO_x and VOCs have been decreasing slightly, which follows the general trend of NO_x and VOC emissions in the U.S. The March Point refineries, Holly Frontier and Marathon, and their associated industries are the main sources of both VOCs and NO_x near the most populated region of the Swinomish Reservation – the Swinomish Village. This indicates that the best monitoring location for O_3 is not in the northern part of the Reservation as it is likely VOC limited due to the large NO_x source (two emitting more than 1000 tons per year).

Mobile sources are an important additional source of O_3 precursors, such as vehicles (cars and trucks), trains, planes, and ships. On the north end of the Reservation are State Route (SR) 20 that brings recreational traffic and the BNSF railroad that delivers material to Fidalgo Island and the March Point refineries. Additionally, the Reservation is surrounded by some of the most heavily traveled shipping lanes in the U.S., which are additional sources of VOCs and NO_x. To the east is the Naval Air Station Whidbey Island, which includes a highly trafficked airport by military planes and jets. The railroad, highways, airports, shipping tracks near Swinomish are shown in Figure 5-7.

For longer distance transport, the winds in the Salish Sea tend to follow the shape of the sea: going southeast (SE) to northwest (NW) or NW to SE where Swinomish is located. Seattle's metropolitan area is to the SE of the Reservation, so there are likely AQ influences from the city's mobile and industrial sources. Farther flung sources, such as Portland, OR and across the Pacific Ocean, may impact background AQ, but by exactly how much would need dedicated study.

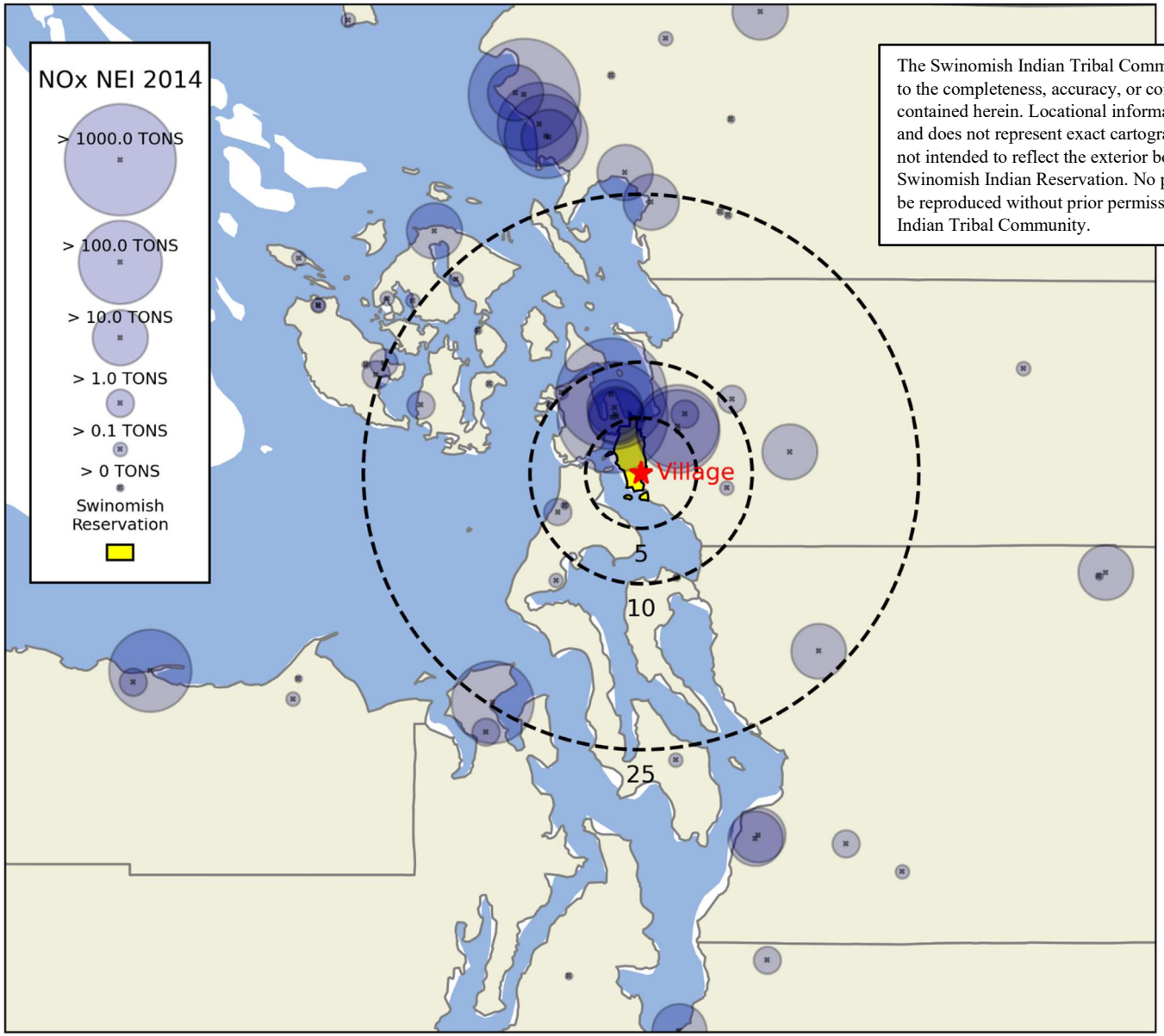


*Figure 4-1: **Annual** NO_x emissions from point sources in 2014 from the EPA NEI.*

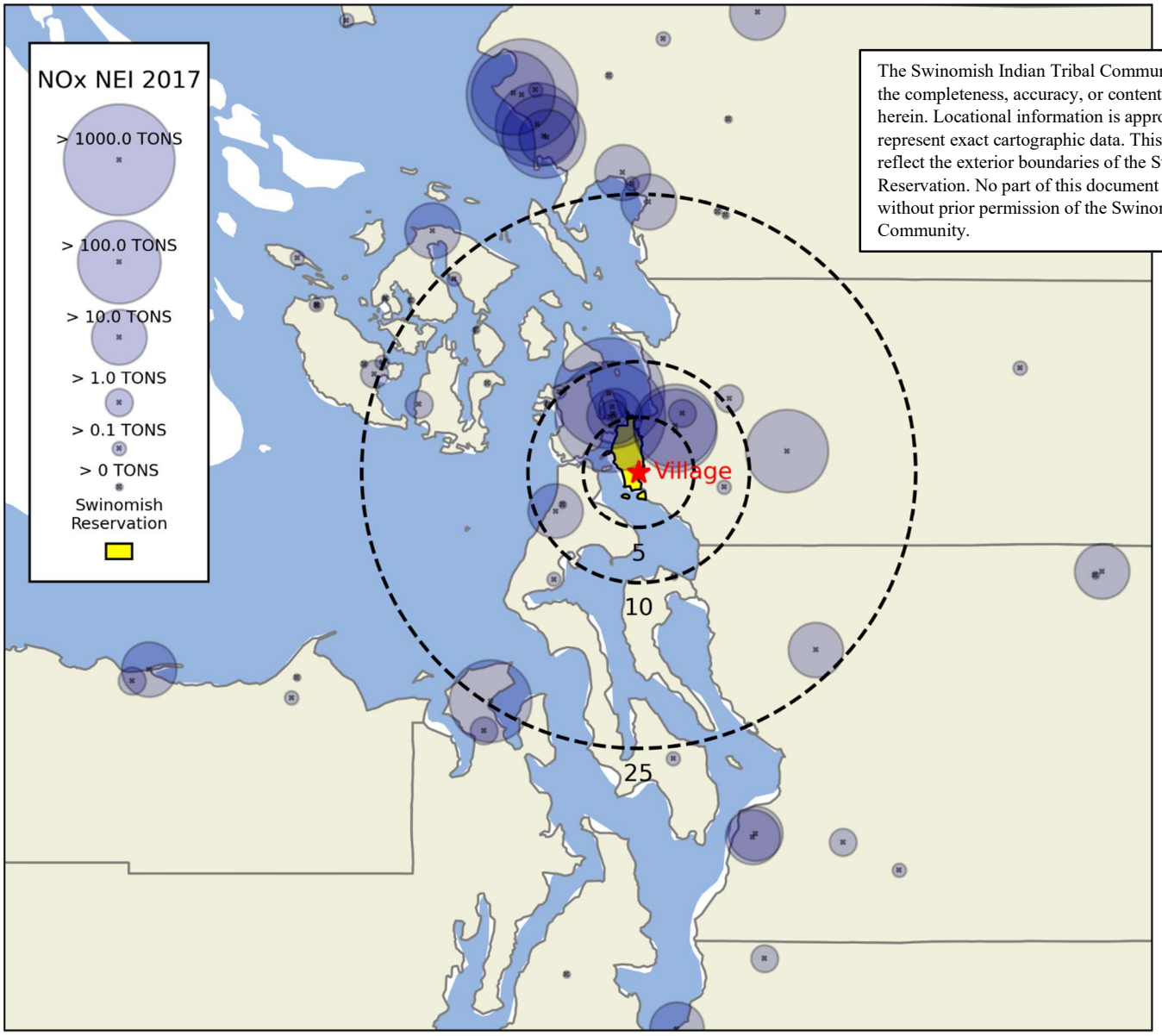


Figure 4-2: Annual NO_x emissions from point sources in 2017 from the EPA NEI.

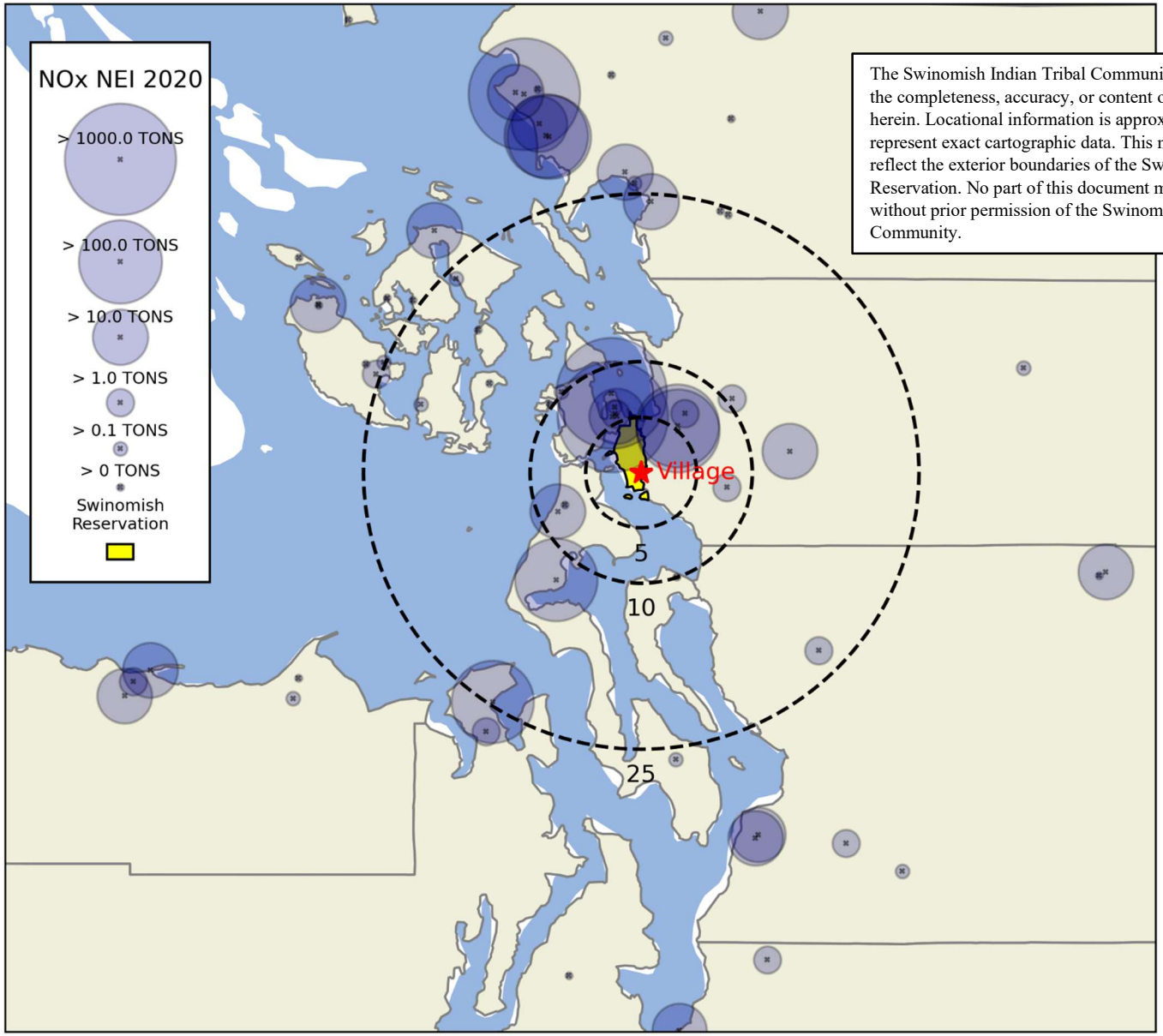


Figure 4-3: Annual NOx emissions from point sources in 2020 from the EPA NEI.

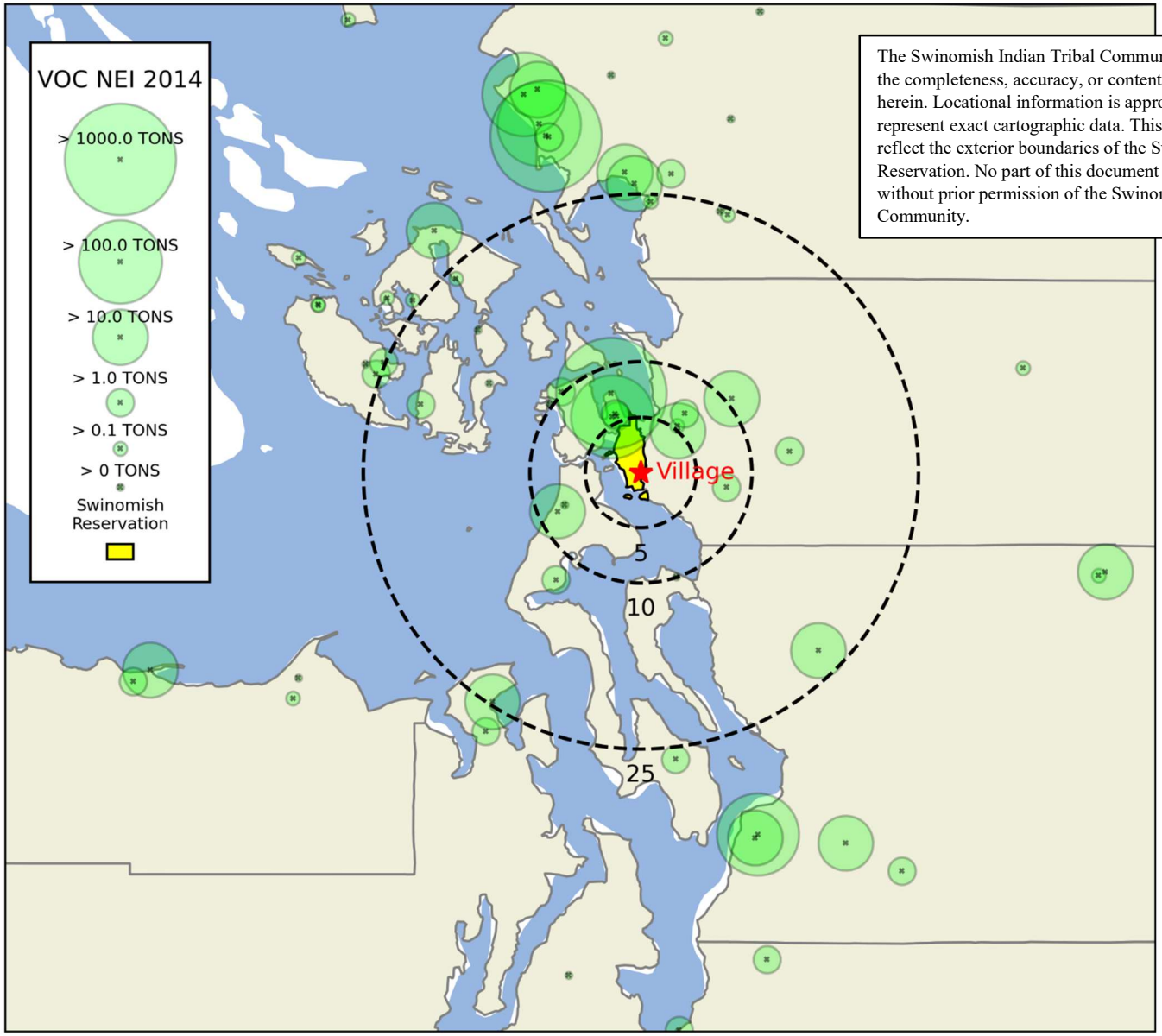


Figure 4-4: Annual anthropogenic VOC emissions from point sources in 2014 from the EPA NEI

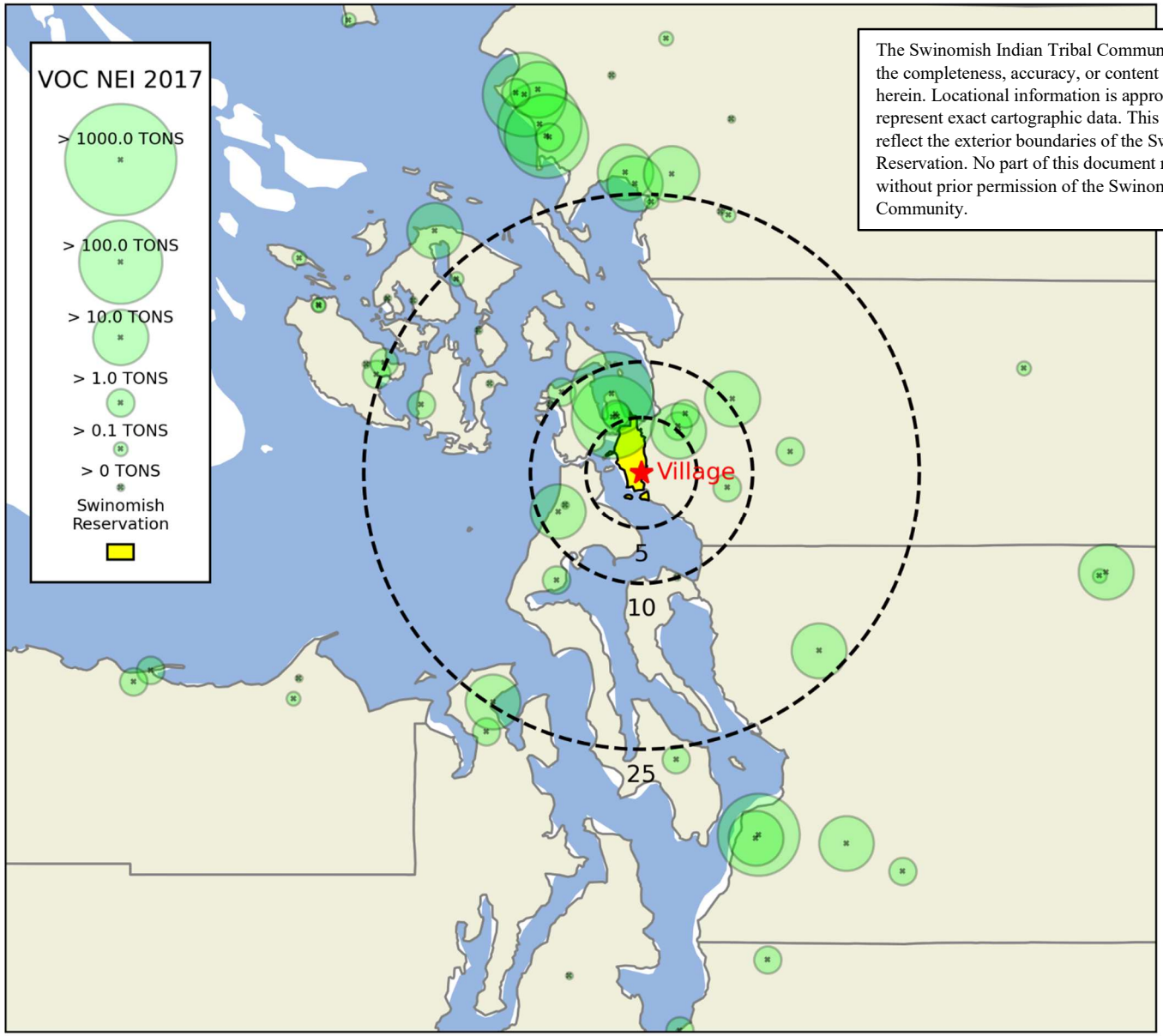


Figure 4-5: Annual anthropogenic VOC emissions from point sources in 2017 from the EPA NEI

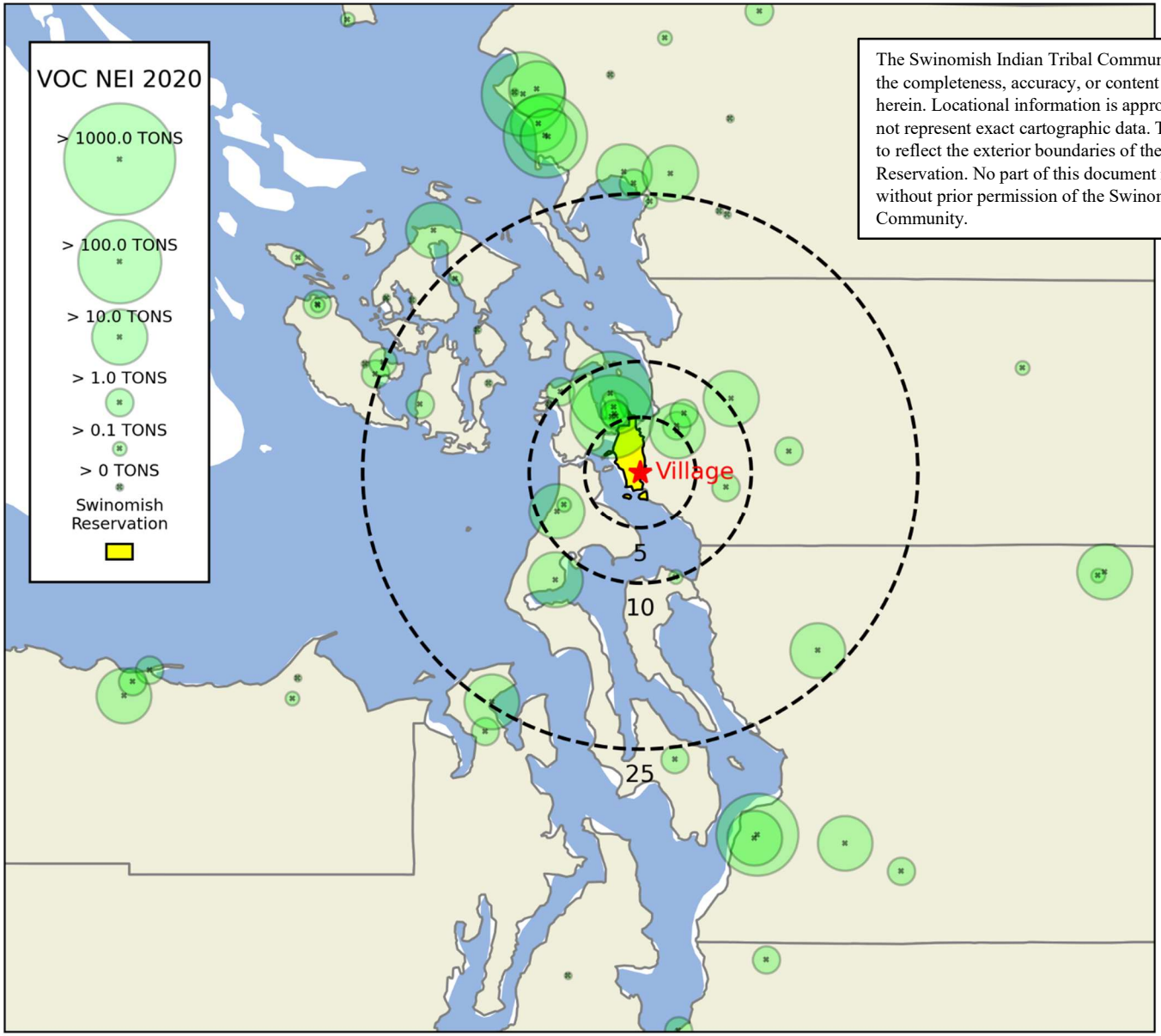
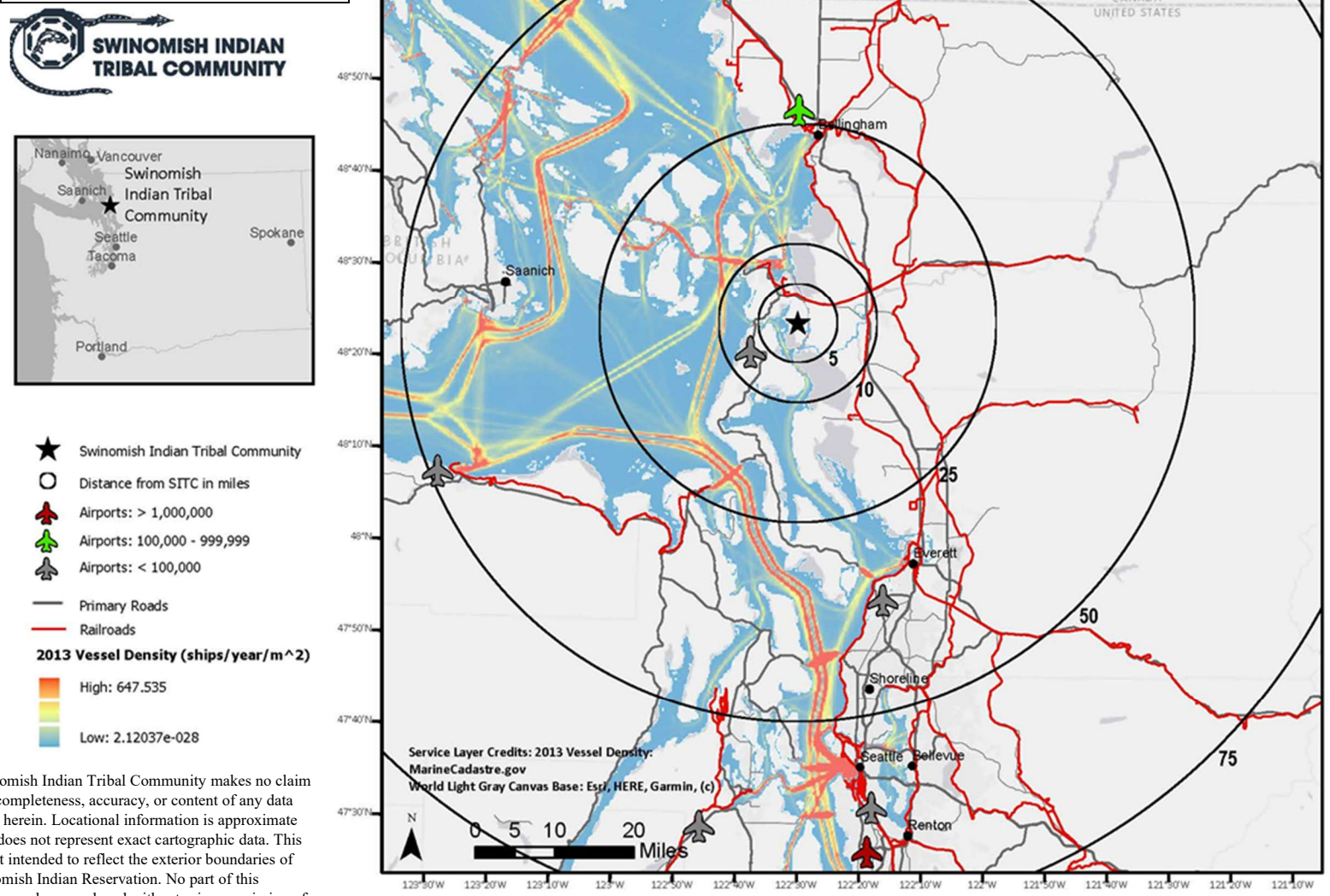


Figure 4-6: Annual anthropogenic VOC emissions from point sources in 2020 from the EPA NEI.

Figure 4-7: Mobile Emission Sources within 75 miles of the Reservation



Element 5 - PROJECT TASK DESCRIPTION (A5)

The measurement goal of this O_3 portion of SAAP is to measure the concentration, in units of parts per million and parts per billion (ppm and ppb, respectively), of O_3 in ambient air for the enforcement of the NAAQS and create a real-time public portal for the public. The performance requirements of the analyzer have been specified in Appendix D of 40 CFR Part 50. The method used is an automated system that performs measurements 24 hours a day, using a method designated as an EPA equivalent monitor in accordance with 40 CFR Part 53. SAAP selected a Thermo Environmental Instrument Model 49i (TEI 49i) which is designated by EPA as an automatic equivalent method (EQOA-0880-047) for monitoring ozone.

Where applicable and practical, SAAP will follow guidance pertaining to ozone monitoring including the following regulatory publications:

A. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program (EPA-454/B-13-003, January 2017),
B. Ambient Monitoring Guidelines for the Prevention of Significant Deterioration (PSD) (EPA 450/4-87-007, May 1987),
C. EPA Requirements for Quality Assurance Project Plans (QA/R-5) EPA/240/B-01/003, March 2001),
D. Guidance for Preparing Standard Operating Procedures (SOPs) EPA QA/G-6 (EPA/240/B-01/004, March 2001),

5.1 - Monitoring Locations

Swinomish has established one SAQMS (SAQMS1) at the Swinomish Casino, near March Point. A second SAQMS is planned to be built in 2026 within the most populous region of the Reservation in the Swinomish Village (SAQMS5). Plans are to monitor ozone at SAQMS1 until SAQMS5 can be built. For this specific project, the monitoring station will include the following:

- Environmentally controlled shelters,
- TEI 49i Ozone Analyzer,
- Agilaire Site Node 8872 (data logger),
- Campbell Scientific Model CR1000 data logger,
- Teledyne Advanced Pollution Instrumentation (TAPI) Model T700 Dynamic Dilution Calibrator,
- TAPI Model T701 Zero Air System,
- Teflon® inlet system, designed to ensure less than 20 seconds residence time and to satisfy the monitoring probe criteria as established in Section 9 of 40 CFR Part 50, Appendix E, and
- Ethernet connection OR wireless router with cellular modem.

Multipoint calibrations and daily one-point QC precision checks are performed using a TAPI T700 Dynamic Dilution Calibrator which includes a Level-2 photometer traceable to the California Air Resources Board (CARB)'s Level-1 photometer. This system combination allows calibration gases to be accurately generated in the range of 10 to 1000 ppb. The Agilaire 8872 Site Node (8872) performs an automated zero, precision, and span (ZPS) checks from 02:46 to 03:14 every night for the values of 0, 70, and 120 ppb of O_3, respectively.

5.2 - Monitoring Schedule Overview

5.2.1 - NAAQS Enforcement Schedule

O_3 season in Washington State is defined by 40 CFR Part 58 Table D-3 as beginning in May and ending in September. For the entirety of O_3 season, SAAP will monitor O_3 for the enforcement of the NAAQS.

5.2.2 - Field Activities

The SAAP staff will perform those activities that support continued successful operation of the O_3 monitoring site. These listed personnel will perform field activities that include but are not limited to conducting calibrations and routine QC checks, periodic preventative maintenance, and servicing equipment located at the SAQMS. Operational servicing activities may include but are not limited to recording pertinent field data and restocking consumables, such as particulate filters, at the monitoring site. Routine field activities are detailed in Elements 10 and 15, and routine QA/QC activities are detailed in Elements 14 and 16.

5.2.3 - SITC DEP Staff Activities

The SAAP staff will perform those activities necessary to support monitoring O_3 for the enforcement of the NAAQS. They will perform electronic laboratory activities consistent with certifying, calibrating, and testing all equipment before installing it in the field. In addition, SITC DEP staff will perform any functions necessary to support the deployed field equipment (e.g., budgeting, communicating with leadership, etc.).

5.2.4 - Reporting to AQS

Hourly values as well as the supporting QC results will be uploaded 90 days after the end of the quarter to AQS. The reports will be issued to the granting agency at least every quarter. Final data certification in accordance with EPA requirements (https://www3.epa.gov/ttn/amtic/qacert.html), including generating the required reports, will be conducted annually every April. Therefore, the certification package can be released by May 1 of each year.

5.3 - Assessment Techniques

An assessment is an evaluation process used to measure the performance and 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, peer review, inspection, and surveillance. Element 20 details assessments. Table 5-1 provides information on the parties implementing assessments and their frequency.

Table 5-1: Assessment schedule.

Assessment Type	Assessment Agency	Frequency
QAPP review and updates	SITC	Review annually Update at least every 5 years
SOP review and updates	SITC	Review annually Update at least every 3 years
Site Management Plan (SMP) review and updates	SITC	Biannually
Data Management Plan (DMP) review and updates	SITC	Biannually
Quarterly Data Report (Level 1-3 Checklist)	SITC	Quarterly
Annual data certification	SITC	Annually
EPA Technical Systems Audit (TSA)	EPA R10	Every 3 years
National Performance Audit Program (NPAP)	EPA R10 designated contractor	20 % of sites per year/each site once every 6 years (i.e., one site audited yearly)
Annual performance evaluation	SITC	All sites annually

Element 6 - INFORMATION/DATA QUALITY OBJECTIVES AND PERFORMANCE/ACCEPTANCE CRITERIA (A6)

As described in the EPA guidance for QAPPs (QA/G-5), the DQOs are defined as the:

> "qualitative and quantitative statements derived from the DQO planning process that clarify the purpose of the study, define the most appropriate type of information (data) to collect, determine the most appropriate conditions from which to collect that information, and specify the tolerable levels of potential decision errors. DQOs are based on the requirements of the data user, or decision maker. By meeting these objectives, a high level of confidence is established regarding the quality of data used to make environmental decisions. DQOs assess the adequacy of data (new or existing) in relation to the intended use."

This section will begin by outlining the DQOs and MQOs (i.e., QC limits) for the SAAP's O_3 monitoring project for the purpose of NAAQS enforcement to ensure good data quality.

6.1 - DQO Evaluation

As SAAP are using the MQOs established by EPA, the DQO process has been implemented because it is strongly advised to do so in the EPA QA Handbook. This process is described below:

6.1.1 - Stating the Problem

The Swinomish Village is located at the confluence of O_3 precursors from the March Point petrochemical industry and downwind of a major metropolitan area (Seattle, WA). With the increasingly frequent extreme heat days that correspond with stagnant high-pressure systems, the likelihood of having the right conditions for a NAAQS exceedance are increasing. Over the past five years, the monthly mean summertime temperatures at Swinomish have been consistently 1 to 2 degrees Celsius higher than the historical baseline (1971-2001) measured at Naval Air Station Whidbey Island.

The closest continuous ambient O_3 monitors are located in Mt. Vernon (~10 miles northeast of the Swinomish Village) and Anacortes (~11 miles north northwest of the Swinomish Village). When prevailing winds result in plumes of precursors being carried over the Swinomish Village, these sites cannot provide information about the O_3 production within the plume. Swinomish does not currently have instantaneous O_3 monitor in the Swinomish Village, which is also far enough from sources where O_3 production could occur.

Because of the location of the Swinomish Reservation and the shifting summer climate, the community seeks to:

1. Monitor ambient levels of O_3 at NAAQS enforcement standards,
2. Identify if monitored O_3 concentrations exceed the NAAQS for O_3 primary and secondary levels (Table 7-2), and
3. Identify if monitored O_3 concentrations exceed the WA Department of Ecology Acceptable Source Impact Level (ASIL) and the National Institute for Occupational Safety and Health Recommended Exposure Limit (REL) (Table 7-3).

6.1.2 - Identify the Inputs to the Decision

The type of data needed is defined by the intended use of the data.

- For comparison purposes to investigate abnormal high levels, SAAP will compare O_3 concentrations to nearby Northwest Clean Air Agency (NWCAA) monitors.
- To determine sources for abnormal and elevated air pollutant levels, the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model online portal will be utilized to calculate back trajectories using the High-Resolution Rapid Refresh (HRRR) weather model.

6.1.3 - Define the Boundaries of the Project

The spatial boundary is determined by the sites where the monitors are placed, with the associated assumptions (Element 10) about the representativeness of these locations.

- Acute:
  - Real-time concentrations of O_3 above 125 ppb with likelihood of remaining at or reaching higher concentrations.
    - This lines up to when the air quality index (AQI) is calculated with hourly concentrations and when the AQI is Unhealthy for Sensitive Groups (USG) due solely to O_3.
    - The real-time trends with associated meteorological information will be used to provide guidance on community safety which can include but are not limited to shelter in place and evacuation orders issued by emergency management staff.
- Chronic:
  - The temporal boundary for O_3 requires 8-hour running average of O_3 for three full years. The 24-hour average values will be assessed on an ongoing basis in case high levels are measured, and in that case, the AQI will be used to provide information to the public.

6.1.4 - Deciding on a Decision Rule

Consistent with the SAAP objective to provide information to the community, SAAP will:

- Have a data acquisition system (DAS) system running Level 0 QA/QC on all data posted in real-time. When QA/QC issues are identified, the instrument will be removed from real-time posting.
- Evaluate 1- and 8-hour averages as SAAP gather the data and issue public health advisories if the AQI indicate that any population is at risk.
- If there are large deviations from the O_3 concentration background, SAAP will use meteorological observations and modeling to determine the source of the precursors.
  - In the summertime, ambient background O_3 levels are around 30 ppb from previous O_3 monitoring at Swinomish. A more detailed background analysis will be determined at the new SAQMS.
- Evaluate 8-hour averages as data are collected and report exceedances to SITC DEP management to determine further steps which may include community reporting. Regardless of individual samples, annual reports in the form of internal reports (annual AQ section report, annual DEP report to Senate) and external communication via qyuuqs articles will be used to summarize findings to the community.

6.1.5 - Specifying Tolerable Limits on Decision Error

The DQO process defines tolerable limits on the probability of making a wrong decision because of uncertainty in the data (i.e., limits on the probability of coming up with a false positive or a false negative error). Examples of wrong decisions made is as follows:

- False positive error when the O_3 data indicate a monitor exceeded the 125 ppb, when in fact, due to random deviations in the data, the monitor did not exceed it.
- False negative error when the O_3 data indicate the monitor did not exceed the 125 ppb, when in fact, due to random deviations in the data, the monitor did exceed it.

The Acceptable Precision and Bias for automated O_3 monitoring is listed below in Table 7-1.

Table 6-1: Acceptable precision as measured by coefficient of variation (CV) and bias for CAPs and precursors.

Pollutant	Acceptable Precision	Acceptable Bias	Reference
O_3	Upper 90% confidence limit for the CV of ≤ seven percent (7%)	Upper 95% confidence limit for the absolute bias of ≤ seven percent (7%)	40 CFR Part 58, Appendix A, Section 2.3.1.2

6.1.6 - Optimizing the Design

The design has been optimized to fit the budget and the needs of SITC. Priority has been placed on the objectives presented in Element 6, using a method that meets the instrument's performance requirements of measurements to determine:

- Exceedances of state and federal limits for the health and safety of the public and environment as detailed in Table 7-2 and Table 7-3 for O_3.

Table 6-2: Primary and secondary NAAQS of O_3.

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
O_3	Primary and secondary	Eight hours	0.070 ppm	Annual fourth-highest daily maximum eight-hour concentration, averaged over three years

Table 6-3: Classification of O_3 as a HAP or TAP, and ASILs from WAC 173-460-150, REL from NIOSH, and TWA from OSHA from 29 CFR 1910.1 Table Z-1.

			WAC 173-460-150		***NIOSH***		***OSHA***	
Name [CAS]	**HAP**	**TAP**	**ASIL (ug/m3)**	**Averaging Time**	**Ceiling REL**	**Unit**	**8-hr TWA**	**Unit**
Ozone [10028-15-6]	N	Y	1.8E+02	One-hour	100	ppb	100	ppb

6.2 - Measurement Quality Objectives (MQOs)

Once a DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. MQOs are designed to evaluate and control various phases (i.e., sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs.

MQOs can be defined in terms of the following data quality indicators (DQIs):

- **Precision** – the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Simply stated, precision is a measure of the variability of an instrument. This is the random component of error. The precision of automated analyzers is evaluated by making multiple comparisons of the sample's known concentration against the instrument's response and calculating the upper bound of the coefficient of variation (CV), as referenced in 40 CFR Part 58, Appendix A. Results from the daily one-point QC checks will be utilized in the precision calculations. A summary of the precision data and calculations will be included in the routine quarterly reports. CV is calculated automatically by the EPA's data assessment statistical calculator (DASC) following the equation below.

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

Where:
n is number of single point checks being aggregated,
d_i is the percent difference, and
$\chi^2_{0.1,n-1}$ is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom

- **Bias** – the systematic or persistent distortion of a measurement process which causes error in one direction. For continuous gaseous pollutant measurements (O_3), the bias estimate is calculated using the one-point QC checks as described in 40 CFR Part 58 Appendix A, Section 3.1.1 (One-Point Quality Control Check for O_3). The bias estimator is an upper bound on the mean absolute value of the percent differences calculated on a quarterly basis. Bias is calculated and a sign assigned automatically by the EPA's data assessment statistical calculator following the series of equations below.

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

Where:
n is number of single point checks being aggregated,
AB is the mean of the absolute values of the percent differences,
AS is the standard deviation of the absolute values of the percent differences, and
d_i is the percent difference, and

$$AB = \frac{1}{n} * \sum_{i=1}^{n} |d_i| \qquad AS = \sqrt{\frac{n * \sum_{i=1}^{n} |d_i|^2 - \left(\sum_{i=1}^{n} |d_i|\right)^2}{n(n-1)}}$$

- **Accuracy** – a measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations. The accuracy of automated methods is assessed through field performance audits. Performance audits are conducted by sampling an independent standard (i.e., a standard not used for instrument calibration). Accuracy is evaluated by comparing the measured response to the known value and calculating the percent difference between the known value and the analyzer's response, using the equation below.

$$d_i = \frac{meas - audit}{audit} * 100$$

Where:
d_i is the percent difference,
meas is the monitor's indicated concentration from the audit check, and
audit is the known concentration of the audit gas used for the audit check.

- **Representativeness** – a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point, or for a process condition or environmental condition. Measurement data for this monitoring program are to be representative of the AQ and meteorological conditions within and around the Swinomish Reservation based on the experimental design. Data collected as part of this sampling program are representative of a neighborhood scale.
- **Completeness** – a metric quantifying the amount of valid data obtained from a measurement system compared to the amount that were expected to be obtained under correct, normal conditions. Completeness can be expressed as a ratio or a percentage. Quarterly data completeness (DC_i) will be determined using the following equation:

$$DC_i = \frac{h_v}{h_i} * 100$$

Where:
h_v = number of hours of valid data actually collected
h_i = number of possible valid hours of data collection during the monitoring period.
Note: periods of required maintenance, quality control checks, and audits are excluded from the total number of possible valid hours.

- **Comparability** – the qualitative term that expresses the confidence that two data sets can contribute to a common analysis and interpolation. Comparability must be carefully evaluated to establish whether two data sets can be considered equivalent in regard to the measurement of a specific variable or groups of variables (US EPA QA/G-5, Appendix D). This means all data shall be produced in a similar and scientific manner. The use of the standard methodologies for sampling, calibration, audits, etc. found in this QAPP are meant to achieve this goal. Comparability is ensured by operating instrumentation within the MQOs and following SOPs and procedures identified in the QAPP. Adherence to the QAPP and meeting MQOs are assessed as part of performance and technical systems audits.
- **Sensitivity** – the determination of the low range critical value of a characteristic that a method specific procedure can reliably discern. Detection limits are based on sensitivity of the analytical methods. The federal minimum detection limit of the O_3 analyzers is 5 ppb.

For each of these attributes, acceptance criteria can be developed for various phases of the environmental data operation. These MQOs are shown in Table 7-4 for O_3. In theory, if these MQOs are met, measurement uncertainty should be controlled to the levels required by the DQO.

Table 6-4: O_3 MQOs (UV absorption).

1) Requirement	2) Frequency	3) Acceptance Criteria	Information/Action
CRITICAL CRITERIA – O_3			
Sampler/Monitor		Meets requirements listed in FRM/FEM designation	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One-Point QC Check	Every 14 days is required (SAAP goal is daily automated checks)	<=±7.1% (percent difference between analyzer and known concentration) OR ± 1.5 ppb difference, whichever greater	1 and 2) 40 CFR Part 58 App A Sec 3.1 and Table A-1, 3) Recommendation is based on DQO in 40 CFR Part 58 App A Sec 2.3.1.5 QC Check Concentration range 0.005 - 0.08 ppm relative to mean or median monitor concentration
Zero/Span Check	Every 14 days is required (SAAP goal is daily automated checks)	zero drift by <=±3.1 ppb (24 hrs) OR <=±5.1 ppb (>24hr-14 days) span drift <=±7.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA – O_3			
Shelter Temperature Range	Daily (hourly values)	20 to 30 ºC (hourly average)	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Control	Daily (hourly values)	<= ±2.1 ºC standard deviation (hourly) over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	Every 182 days and two/calendar year	±2.1 °C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Annual Performance Evaluation Single Analyzer	Every site, every 365 days and one/calendar year within period of monitor operation	Zero: 0 ±≤ 3 ppb Non-Zero: <=±7.1% (percent difference between analyzer and known concentration) OR < ± 1.5 ppb difference, whichever greater (See Section 14.5 on levels)	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) AMTIC guidance dated 2/17/2011
Federal Audits (NPAP, TSAs)	20 % of sites audited in calendar year (NPAP) Every three years (TSA)	Audit levels 1&2 < ± 1.5 ppb difference all other levels percent difference < ± 10.1% (NPAP)	1 and 2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP & QAGD Conducting TSAs

Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving/repair and recalibration of standard of higher level two/year Every 365 day and one/calendar year (because continuous zero/span performed daily)	All points (0 and 4 upscale points) within ±2.1% of ppb or < ± 1.5 ppb difference of best-fit straight line whichever is greater and slope 1 ± .05	1) 40 CFR Part 50 App D 2) Recommendation 3) Linearity error is from 40 CFR Part 50 App D sec 4.5.2.3 3) Multi-point calibration variance are from 40 CFR Part 50 App D sec 4.5.5.6.
Zero Air/Zero Air Check	Chemicals changed once/365 days and once/year	Concentrations below lowest detectable level (LDL) (±<1.5 ppb on L2 Photometer compared to Standard ZAG)	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.2 2 and 3) Recommendation
Qualification of O_3 Transfer Standards	Commercial devices - conducted at vendor	Repeatability ±4% or four ppb from its indicated value (whichever is greater)	40 CFR Part 50 App D Section 4.2.1 Appendix E Transfer Standard Guidance EPA-454/B-22-003
Acceptance Testing of O_3 Transfer Standards	Upon receipt, upon repair and prior to conducting verifications or reverifications	Criteria are per manufacturer specifications	40 CFR Part 50 App D Section 4.2.2 Appendix B Transfer Standard Guidance EPA-454/B-22-003
O_3 Transfer Standard's Verification to Standard Reference Photometer 1) Level 2 Bench Standard 2) Level 3 Field Standard	1) One/year; three cycles for verification to SRP (EPA R10 or CARB) 2) One/year; three cycles for verification to Level 2 Bench Standard	Each point difference < ± 3.1% (or ±1.5 ppb for concentration points < 50 ppb) All 3 regression slopes = 1.00 ± 0.03 All 3 regression intercepts = 0 ± 3 ppb Standard deviation of the 3 slopes < 0.0075 Standard deviation of the 3 intercepts < 1.00ppb	40 CFR Part 50 App D Section 4.4.1 Transfer Standard Guidance EPA-454/B-22-003
O_3 Transfer Standard's Reverification to Standard Reference Photometer for 1) Level 2 Bench Standard 2) Level 3 Field Standard	1) One/ year; one cycle to SRP (EPA R10 or CARB) 2) One/six months to Level 2 Bench Standard	Each point difference < ± 3.1% (or ±1.5 ppb for concentration points < 50 ppb) Regression slope from the reverification test cycle must be within ±0.015 of the mean slope from the most recent verification test Regression intercept from the reverification test cycle must be within ±1.5 ppb of the mean intercept from the most recent verification test Regression slope from the reverification test cycle = 1.00 ± 0.03 Regression intercept from the reverification test cycle = 0 ± 3 ppb	40 CFR Part 50 App D Section 4.4.2 Transfer Standard Guidance EPA-454/B-22-003

Detection (FEM/FRMs): Noise	Upon receipt/adjustment/repair/ installation/moving/recalibration or one/year	< 0.0025 ppm (standard range) < 0.001 ppm (lower range)	40 CFR Part 53.23 (b) (definition & procedure), and 40 CFR Part 53.20 Table B-1
Detection (FEM/FRMs): Lower Detectable Limit	one/year	< 0.005 ppm (standard range) < 0.002 ppm (lower range)	40 CFR Part 53.23 (c) (definition & procedure), and 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA – O_3			
Standard Reporting Units	All data	ppm (final units in AQS)	1, 2 and 3) 40 CFR Part 50 App T Sec. 2 (c)
Rounding Convention for Data Reported to AQS	All data	Three places after decimal with digits to right truncated	1, 2 and 3) 40 CFR Part 50 App T Sec. 4.2 (a)
Completeness	Three-year comparison	≥ 90% (avg) daily max available in ozone season with min of 75% in any one year.	1,2,3) 40 CFR Part 50 App U Sec 4(b)
	Eight-hour average	> if at least six of the hourly concentrations for the eight-hour period are available	1) 40 CFR Part 50 App U 2,3) 40 CFR Part 50 App U Sec. 3(b)
	Valid daily max	> if valid eight-hour averages are available for at least 13 of the 17 consecutive eight-hour periods starting from 7:00 a.m. to 11:00 p.m. must be valid.	1) 40 CFR Part 50 App U 2,3) 40 CFR Part 50 App U Sec. 3(d)
Sample Residence Time Verification	At installation, one/365 days and one/calendar year	≤ 20 seconds	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 9 (c)
Sample Probe, Inlet, Sampling Train	All sites	Borosilicate glass (e.g., Pyrex®) or Teflon®	1, 2 and 3) 40 CFR Part 58 App E Sec. 9 (a) FEP and PFA have been accepted as equivalent material to Teflon.
Siting	One/365 days and one/year carefully evaluated	Meets siting criteria or waiver documented	1) 40 CFR Part 58 App E, Secs 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
EPA Standard O_3 Reference Photometer (SRP) Recertification (Level 1)	Every 365 days and one/calendar year	Regression slope = 1.00 + 0.01 and intercept < 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-454/B-22-003

Precision (Using One-Point QC Checks)	Calculated annually and as appropriate for design value estimates	90% CL CV < 7.1%	1) 40 CFR Part 58 App A Sec. 2.3.1.5 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
Bias (Using One-Point QC Checks)	Calculated annually and as appropriate for design value estimates	95% CL < ± 7.1%	1) 40 CFR Part 58 App A Sec. 2.3.1.5 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3

Element 7 - DISTRIBUTION LIST (A7)

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

Distribution List

Name	Organization	Position	Email
Kelsey Larson	SITC	Project & Operation Manager	klarson@swinomish.nsn.us
Sally Vaux	SITC	Field Team Leader & Analyst	svaux@swinomish.nsn.us
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TBD	SITC	QA Data Reviewer	TBD
Shannon B. Stewart	SITC	Quality Assurance Manager	sbuckham@swinomish.nsn.us
Todd Mitchell	SITC	Department Director	tmitchell@swinomish.nsn.us
Cindy Fields	United States Environmental Protection Agency Region 10 (EPA R10)	Quality Assurance Manager	fields.cindy@epa.gov
Sarah Waldo	EPA R10	Senior Air Monitoring Specialist	waldo.sarah@epa.gov
Joey Richardson	EPA R10	Senior Air Monitoring Specialist	richardson.joey@epa.gov
Carl Brown	EPA R10	Grants Project Officer	brown.carl@epa.gov

Element 8 - PROJECT ORGANIZATION (A8)

This agency incorporates quality assurance activities as an integral part of any program that gathers environmental data, including our work in the field, our own data analysis and reporting, and in all consulting and contractors we may utilize. Listed are the project staff titles (not the DEP staff titles). This is a higher-level description of tasks. In each section of this QAPP a section will be included to ensure personnel responsibilities are clear.

8.1 - Project Staff and Roles

The following sections list the responsibilities of each individual in SITC in the DEP:

8.1.1 - Project & Operations Manager, Kelsey Larson

The major quality assurance (QA) related responsibilities of the Project & Operations Manager (P&OM) include:

- Maintaining regular communication with contractors, EPA, and project staff, and ensuring adherence to this QAPP by staff
- Ensuring that all Data Quality Objectives (DQOs) and Measurement Quality Objectives (MQOs) of this QAPP are met
- Writing, revising, and distributing this QAPP, SOPs, DMPs, and SMPs, and all supporting documents such as quality control (QC) forms and checklists
- Level 3 Reviewer as defined by the EPA's August 2021 "Best Practices for Review and Validation of Ambient Air Monitoring Data"
- Completing L3 sections of the Quarterly Data Report
- Performing corrective maintenance that would result in requiring recalibration of instruments
- Recommending necessary corrective actions
- Providing answers to technical questions
- Serving as the program's QA liaison with EPA regional QA managers.
- Preparing, reviewing, and delivering data completeness and summary reports
- Managing and modifying Database to meet needs of air quality (AQ) Program
- Submitting to Air Quality System (AQS) and certifying data to the EPA.

8.1.2 - Field Team Lead & Analyst, Sally Vaux

QA related responsibilities of the Field Team Lead (FTL) & Analyst include:

- Carrying out the work in the field in compliance with the DQOs and MQOs of this QAPP
- Drafting QAPP elements, SOPs, DMPs, SMPs, and all supporting documents such as QC forms and checklists
- Level 1 Data Reviewer as defined by the EPA's August 2021"Best Practices for Review and Validation of Ambient Air Monitoring Data" for all types of data collected
- Completing L1 sections of the Quarterly Data Report

- Ensuring that assessments and audits are scheduled and completed
- Conducting and tracking the results of QC checks, calibrations, audits, and traceability
- Performing, documenting, and tracking preventative maintenance and corrective actions
- Documenting deviations from established procedures and methods
- Tracking monitoring program assets, including inventory of supplies and consumables as well as reordering when needed
- Reporting all problems and corrective actions to AQA
- Entering field collected data into database
- Flagging suspect data

8.1.3 - Field Technician, Wyatt Tanner

QA related responsibilities of the Field Technician (FT) is responsible for:

- Carrying out the work in the field in compliance with the DQOs and MQOs of this QAPP
- Supporting the FTL to draft SOPs and supporting documents such as QC forms and checklists
- Conducts annual Siting and Residence Time Systematic Criteria Checks
- Ensures measurement quality standards are met as required in this QAPP
- Following all manufacturer specifications
- Performing and documenting preventative maintenance
- Documenting deviations from established procedures and methods
- Reporting all problems and corrective actions to AQA
- Entering field collected data into database
- Flagging suspect data

8.1.4 - QA Data Reviewers, TBD

QA related responsibilities of the QA Data Reviewer (QADR) include:

- Flagging suspect data
- Reviewing this QAPP, SOPs, and all supporting documents such as QC forms and checklists
- Level 2 Data Reviewer as defined by the EPA's August 2021"Best Practices for Review and Validation of Ambient Air Monitoring Data" for all types of data collected
- Reviewing that reviews, assessments and audits have been completed
- Completing L2 sections of the Quarterly Data Report
- Reporting any inconsistencies in data flagging to the FLT to correct
- Reporting any QA/QC issues to the P&OM, such as those that would cause any data to be suspect or invalidated

8.1.5 - Quality Assurance Manager, Shannon Stewart

Major QA related responsibilities of the Quality Assurance Manager (QAM) include:

- Ensuring adherence to this QAPP by staff, outside contractors, and consultants as appropriate
- Maintaining regular communication with contractors, EPA, and project staff
- Ensuring that all personnel involved in this program have access to training, equipment, and contract support (outside audits) needed to fulfill the requirements of this QAPP
- Ensuring that all personnel involved in collecting data for this project spend at least 32 hours in training by reviewing and understanding this QAPP and all relevant standard operating procedures (SOPs)
- In case of dispute between the L2 and L3 reviewers (QADR and P&OM) on data quality, determines the appropriate course of action from their input.

8.1.6 - Department Director, Todd Mitchell

Major QA related responsibilities of the Department Director include:

- Reviewing acquisition packages (contracts, grants, cooperative agreements, interagency agreements) to ensure that the QA needs of this program are met
- Maintaining regular communication with all project staff
- Ensuring that all personnel involved in this program have access to the resources needed to fulfill the requirements of this QAPP

8.2 - EPA Regional Office

Regional offices are responsible for addressing environmental issues related to the agencies within their jurisdiction and administering and overseeing regulatory and congressionally mandated programs. The major QA charge of EPA's Region 10 (EPA R10) office is coordinating QA matters at the regional level with their agencies. The EPA regional project officers manage some technical aspects of the program, including supporting the development of QAPPs, evaluating quality system performance through technical systems audits and network reviews, acting as liaisons by making available the technical and quality assurance information developed by EPA Headquarters and the Regions to the tribal air agencies, and making EPA Headquarters aware of the unmet QA needs of the state and local agencies.

8.2.1 - US EPA R10 Quality Assurance Coordinator, Joey Richardson

- Reviewing and approving this QAPP
- Coordinating/performing TSAs
- Coordinating/performing NPAP (EPA Region 10 Contractor)

8.2.2 - US EPA Project Manager, Carl Brown

- Reviewing grant narratives and budgets (and possible budget changes) to ensure that the QA needs of this program are met and documented

Element 9 - PROJECT QUALITY ASSURANCE MANAGER INDEPENDENCE (A9)

SITC does not have a separate QA division. Therefore, two additional staff in the SITC DEP that are not involved in the collection of AQ data will act as the QADR & QAM.

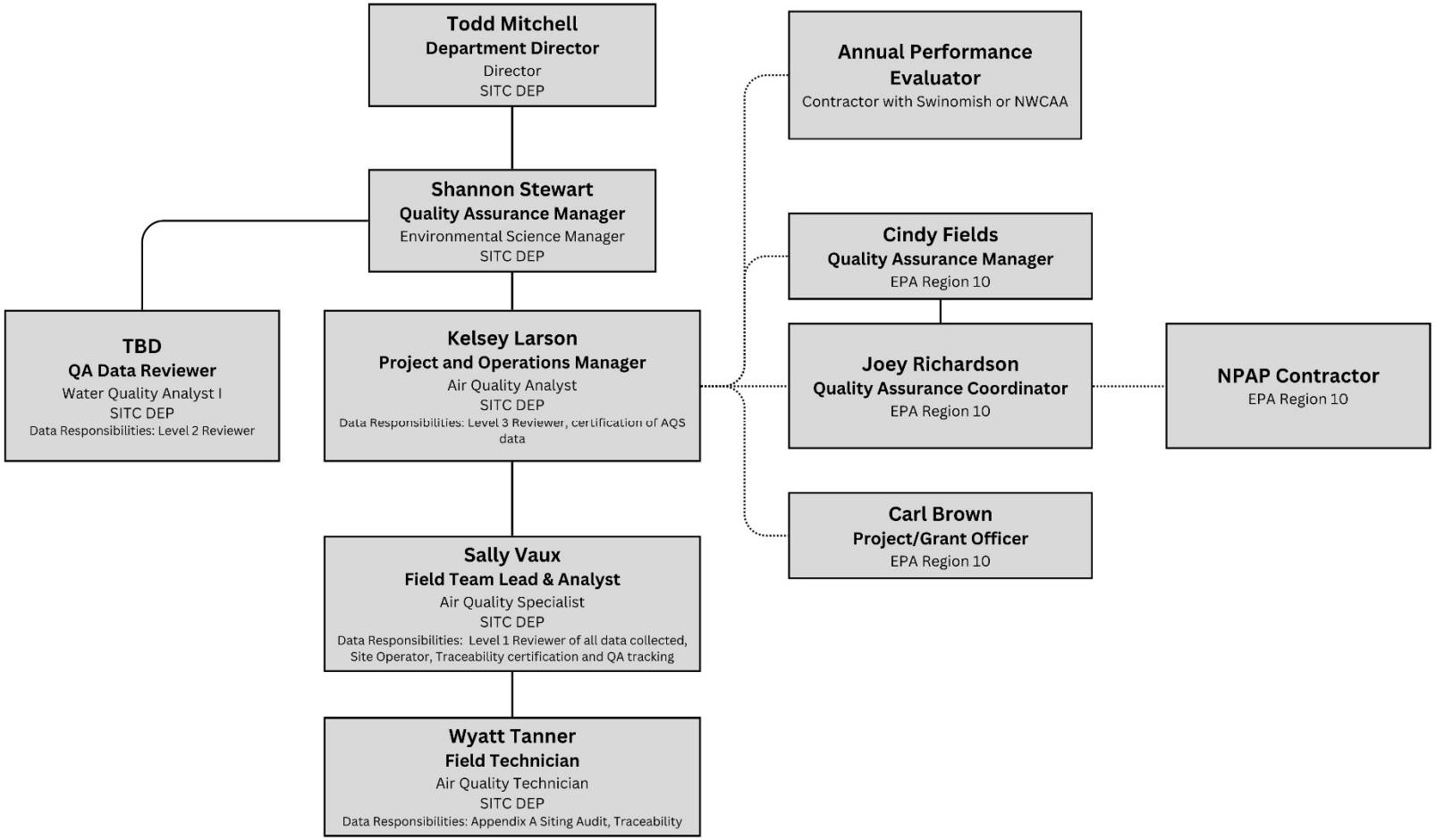
The QADR holds the position of Water Quality Analyst (WQA) in SITC DEP and thus does not participate in the raw data collection or QA/QC activities related to the collection or flagging of AQ data. Thus, the WQA can act as an independent QADR and objectively assess the data according to the quality indicators included in this QAPP. As can be seen in Figure 10-1, the WQA does not report to the P&OM and is two levels of authority away from the FTL who ensures the bulk of the field work is accomplished. The WQA is the most qualified person at Swinomish that could complete the Level 2 data review as they approve and review data collected for the SITC Water Quality Program.

In the event of a disagreement between the QADR and P&OM, the QAM shall act as the final decision maker based on a weight of the evidence approach as described in EPA's August 2021"Best Practices for Review and Validation of Ambient Air Monitoring Data." The Environmental Science Manager (ESM) in SITC DEP holds the position of QAM and thus oversees both the P&OM and QADR. The ESM is the most qualified person at Swinomish that could make this determination as the ESM oversees both SITC's Air Quality & Water Quality Program and previously held the position of the QADR.

Element 10 - PROJECT ORGANIZATIONAL CHART AND COMMUNICATIONS (A10)

Please see Figure 10-1 below.

Figure 10-1: Project organization chart. Solid lines represent organization hierarchy. Dashed lines indicate communication pathways.



Element 11 - SPECIAL TRAINING/CERTIFICATION (A11)

Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. Sufficient time (at least 32 hours, including on-the-job training) will be provided by management to the personnel directly involved in this project (including the AQA, FTL, FT, and QADR) to read and understand this QAPP, referenced SOPs, and other material as directed. A record of training including completion of review of all relevant guidance documents (i.e., QAPPs, SOPs, DMPs, SMPs, etc.) and completed demonstrations of required tasks are recorded in the Training Log Project in Asana (template page in Element 25). Asana allows for the tracking of completed number hours for each task on a cloud server accessed by phone and computer. Plans for the individual demonstrations in the training log (marked "Video Demo") are to be recorded for future training and retention of institutional knowledge.

Activities related to this program are performed by individuals with appropriate training and experience, as described below.

- Field oversight personnel (FTL) have a minimum of 1 year of experience operating AQ and meteorological monitoring instrumentation or similar equipment in the field of environmental science. These individuals are required to adhere to this QAPP and the project SOPs when conducting or overseeing field activities. Training activities will be recorded by the employee's supervisor (usually the P&OM).
- Field technicians (FT) will have at least two months of training with field oversight personnel before conducting smaller data collection tasks and maintenance (i.e., checking filters and replacing filters, inspecting sample lines, etc.) solo.
- Data management and validation are performed by individuals who understand the measurement principles, are familiar with the MQOs, and have demonstrated proficiency with Swinomish's data management procedures, by working with the AQ Level 3 reviewer (P&OM). This means that the QADR will spend at least 32 documented hours reviewing this QAPP, especially Element 14 (data validation tables) and Elements 20 through 24, all relevant SOPs, the DMP, and relevant manufacturers and EPA websites.
- Required data analysis and interpretation will be performed by the P&OM and FTL with greater than five years of experience in environmental science. If AQ modeling products are used, only those with AQ modeling training will do the analysis.

There are no professional certifications required for the SAAP. Workshops and online courses hosted by Northern Arizona University's Institute for Tribal Environmental Professionals (ITEP) and other similar resource agencies will be made available to project personnel. Personnel have adequate time to review instrument manuals, read QA/QC documents (QAPP & SOPs), and monitor literature and/or EPA regulations. Records of personnel qualifications and training are maintained in personnel files and are accessible for review during audit activities. Swinomish keeps training records for each level of data review in Asana, which are accessible to staff and their managers. In general, it is the responsibility of the P&OM that training logs are updated annually. Adequate education and training are integral to any monitoring program that strives for

reliable and comparable data. SITC DEP also monitors the availability of training courses offered by EPA's Air Pollution Training Institute, EPA R10, ITEP, and private firms. Such institutions conduct professional services and ensure certification of their courses offered. When circumstances are warranted, staff members may be enrolled in one or more training courses offered by these institutions. Whenever a mentor, experienced staff, partnering tribe or state are available, staff are expected to work with them until such time that they can perform the activity independently. Any extra training is also recorded in the Asana Training Log including but not limited to HAZWOPER, ICS, programming classes, etc.

Element 12 - DOCUMENTS AND RECORDS (A12)

SAAP keeps a DMP up to date on at least a biennial basis. This plan includes but is not limited to locations of any and all relevant AQ monitoring data, documents, and records, personnel responsibilities, required software and equipment, and how data flows from raw one-minute data values to approved one-hour averages submitted to AQS. This section contains a subset of the information in the DMP to give an overview of the record locations and important SOPs for the DMP.

12.1 - Document and Record Locations

SITC primarily keep electronic files; most (if not all) data files are uploaded to the AirVision SQL database stored on the Swinomish server and managed by the Swinomish IT Department. Any paper files that are generated (e.g., National Institute of Standards and Technology (NIST) traceability documents from vendors) are scanned to create electronic copies for both security and back-up purposes. Electronic files are stored in a couple of places:

- Swinomish Network (\\SITC2\) – The Swinomish Network is managed by Swinomish IT. \\SITC2\ is backed up daily on multiple servers. Access to the server requires administrator-level (e.g. Director of DEP) requests for access. Most if not all DEP files are kept under \\SITC2\Planning\USER\WATER\.
- AirVision Server (\\AVS\) - The AirVision SQL database stored on \\SITC2\ managed by the Swinomish IT Department. Access to the SQL database requires the download of the AirVision Client Software by Swinomish IT as well as an AirVision account being created by the P&OM. Each AirVision account is given a "Role" that allows for different read/write access to the account.
- LabArchives – Cloud-based eLogbook application. Subscription-based service with ability to download as PDF to \\SITC\. Access is through mobile application or website. Read-only access for the external auditor would need to be set up by P&OM. See Element 25 for LabArchives SOP.
- Dataloggers – Dataloggers collect data records at specified time intervals. Accessed remotely from the SITC network connection or at a SAQMS. There are two different kinds of dataloggers:
    - Agilaire 8872 SiteNode (on monitoring site location)
    - Campbell Scientific CR1000 or CR1000X
- Instruments – The 49i and the multi-gas calibration system's multi-gas calibrator (T700U and 146iQ at SAQMS1) also collect raw data records at specified intervals. Accessed at SAQMSs.
- Staff Laptops – Temporary storage location (C:\Campbellsci\LoggerNet\Data) of data and metadata records until transferred to \\SITC2\.

12.2 - Document and Record Upkeep

Swinomish DEP has a "File Management Protocol" for DEP files that describes the archiving process of physical files in detail. Generally, data files and records and supporting

documentation (e.g., data logger programs) are kept minimally in five (5) years in electronic form. Physical documents are kept for at least five (5) years before going to the Swinomish Archiver to determine if they should be kept.

Additionally, SAAP keeps an annually updated “Data Management Plan for the Ambient Air Monitoring Program" which includes more details on allowable file types, file and data us, access, sharing, privacy, etc. These practices were created to be in compliance with the EPA’s Guidance for Air Monitoring Data for the enforcement of the NAAQS in the “EPA QA Handbook Ambient Air Monitoring Volume II: Ambient Air Quality Monitoring Program”. In this biennial update, all the following SOPs (Element 25) must be reviewed and updated if there have been changes:

- AirVision Software SOP
- LabArchives SOP
- Management of Historical AQ Data Files SOP

GROUP B: DATA GENERATION AND ACQUISITION

Element 13 - IDENTIFICATION OF PROJECT ENVIRONMENTAL INFORMATION OPERATIONS (B1)

This element explains the "how and why" of the project's information collection design to ensure that the appropriate data are collected for this project.

13.1 - Analyzer FRM/FEM

The goal of this project is to monitor the ozone concentrations on the Swinomish Reservation for the enforcement of the NAAQS. The analyzer selected for ozone monitoring for the enforcement of the NAAQS has the following performance requirements specified in Appendix D of 40 CFR Part 50. Analyzers that the EPA has approved for enforcement of the NAAQS are given the designation of a Federal Reference Method (FRM) or a Federal Reference Equivalent (FEM). The TEI 49i is approved as a FEM for ozone in 45 FR 57168:

> **Thermo Environmental Instruments, Inc. Model 49i U.V. Photometric Ambient O3 Analyzer**, operated with a sample flow rate of 1 to 3 Lpm on any measurement range between 0-0.051 to 1.0 ppm, with any time average setting between 10 and 300 seconds, operated at temperatures between 5°C to 40°C with the temperature and/or pressure compensation on or off, at frequencies of 50/60Hz and voltages of 90 to 110 VAC, 105 to 125VAC, and 210 to 250 VAC, with or without any of the following options: 2 Teflon particulate filter, Internal Zero Air Scrubber, Internal Ozonator with remote activation, Rack mounts; Model 49C: Internal Ozonator, Carrying Handle, 4-20 mA current output, RS-232 Interface, RS-485 Interface;

Swinomish will operate the 49i with a range of 150 ppb (0.15 ppm) with a time average setting of 60 seconds, the pressure and temperature compensation on. SAAP will also include the optional additional equipment:

- Nafion™ Dryer Assembly
- In-line PTFE particulate filter (47mm with diameter 1-2 microns)

The 49i determines the ambient concentration of ozone by splitting the sample gas into two streams: sample and reference. The reference stream flows through an O_3 scrubber to create the reference gas. The two streams are sent to two cells (cells A and B) that alternate every 10 seconds. The difference in intensities is proportional to the O_3 concentrations measured by detectors A and B. Thus, the flows and intensity through both cells become an important aspect of the 49i to monitor.

Additional information on the performance of the 49i analyzer (hereafter known as "diagnostics") will also be collected at the same time as the ambient ozone concentration. The diagnostics are listed in

Table 13-1 with their units and acceptable/required ranges. The diagnostic ranges are required if they are explicitly stated in the above description from 45 FR 57168. Otherwise, the

diagnostic range is considered acceptable based on the instrument manual or other technical guidance.

Table 13-1: Diagnostic information, units, and their acceptable or required range.

Diagnostic	Units	Acceptable Range	Required Range
Cell A Flow	LPM	0.4 – 1.6	
Cell B Flow	LPM	0.4 – 1.6	
Total Flow (Cell A + Cell B Flow)	LPM		1.0 – 3.0
Cell A Intensity	Hz	65,000-120,000	
Cell B Intensity	Hz	65,000-120,000	
Bench Temperature	°C		5 – 40
Lamp Temperature	°C	50 -60	
Sample Pressure	mmHg	720 - 780	

13.2 - Monitoring Locations

To evaluate the ambient concentration of ozone to determine compliance with the NAAQS, SAAP established one (1) state and local air monitoring station (SLAMS) within the bounds of Reservation. This location (shown on Figure 10-1 as SAQMS1) was selected as the only monitoring site that currently meets the requirements in Appendix E to 40 CFR Part 58 and can house instruments. The AQS ID for SAQMS1 is 53-057-0018. Plans are to move the site to a more central location once a new station is built (shown on Figure 10-1 as SAQMS5).

The SAAP monitoring network is evaluated biennially through a SMP. This includes detailed information on the locations, instrumentation, and waivers and approvals. The SMP also discusses in detail the reasoning and processes for site selection for all SAQMS. While Swinomish is not required to update its SMP as states are, past experience has highlighted the need for documentation with at least biannual updates to sampling site descriptions in previous Swinomish QAPPs. Utilizing a SMP and instituting biannual updates to the EPA will hopefully avoid monitoring location issue in the future.

13.3 - Monitoring Scheduling

The concentration of ozone in the lower troposphere is dependent on the amount of UV radiation the reaches the surface. Because of this, ozone is highly seasonal and more prevalent in the northern hemisphere in the summer months. The ozone season is defined as starting May 1st and lasting to September 30th in Washington state in 40 CFR Appendix D to Part 58 Table D-3. SITC will be monitoring ozone at the Swinomish village for the enforcement of the NAAQS for the entirety of ozone season.

The schedule of QA practices for data collection of CAPs and precursors is described further in Table 13-2.

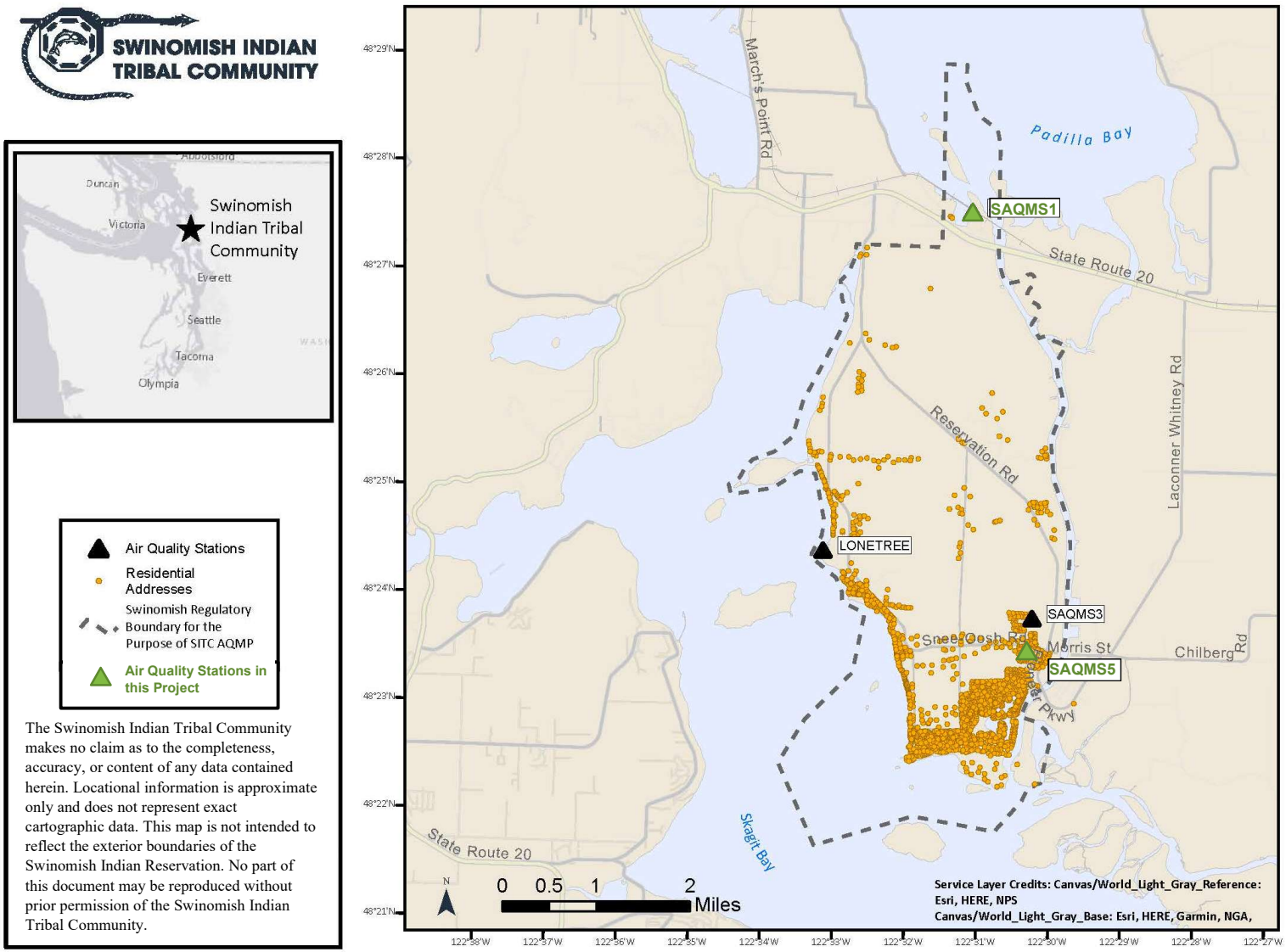


Figure 13-1: Location of SAQMS and residential addresses on Swinomish Reservation.

Table 13-2: QA schedule for O_3.

Item	Daily	Three-Days	Weekly	Biweekly	Monthly	Quarterly	Semi-annually	Annually
Verify that displays on all instruments have values that are reasonable for current meteorological conditions and season		GOAL	X					
Inlet free of impairment (i.e., insects, no water in sample line)			X					
Compare time on system clocks to FTL watch that was recently compared to NIST time on internet; time accurate to ~1 min.			X					
Create plots of concentrations to include in SITC DEP reports						X		X
Conduct ZPS checks	GOAL			X				
Conduct QC checks		GOAL		X				
Conduct multi-point verifications						X		
Sky check: note and record sky conditions, unusual weather, instrument behavior, and flaring			X					
Back-up data to SITC server					X	X		
Check/replace filters as necessary			GOAL	X			X	X
Calibrate instruments. Repair and replace parts as necessary								X

13.4 - Staff Responsibilities

In the table below, tasks are listed by sampling task and the staff member(s) responsible for the tasks are marked. In general, the FTL is the main driver of all field activities and oversees the FT, who assists in routine sampling tasks. The P&OM will support with higher level tasks to keep Level 1 and Level 3 review split for data quality reasons.

Table 13-3: Staff responsibilities regarding the sampling tasks of O_3.

Task	P&OM	FTL	FT
Procurement of consumables, maintenance kits, etc.			X
Routine maintenance (replacing filters, inspecting and replacing sample lines, pump rebuilds, etc.)		X	X
Routine QA/QC activities that are not automated, data downloads, etc.		X	X
Monitoring QA/QC results and data quality	X	X	
Identifying data anomalies, instrument problems and alarms, inventory needs, etc.	X	X	X
Troubleshooting instrument issues, resolving QA/QC issues		X	(assists)
Ensuring the traceability of standards (photometer, flow standards, etc.)		X	X
Determining how to resolve major instrument malfunctions, calibration needs, and data losses	X	X	
Coordinating external audits and data reviews	X	X	

Element 14 - METHODS FOR ENVIRONMENTAL INFORMATION ACQUISITION (B2)

This element details how samples or information will be collected and how the instruments will be deployed and operated to ensure that the electronic data will not be corrupted or lost. The following sections summarize the utilized methods, and more detail is provided in Swinomish SOPs, which are identified in Element 25.

14.1 - Network Comparability

As previously stated, there will only be one monitoring location on the Swinomish Reservation in the SAAP network to monitor ozone for the enforcement of the NAAQS. Thus, the constraints on the sample train and the analyzer must align with the 40 CFR Part 50 and 40 CFR Part 58 for NAAQS enforcement for comparability across PQAOs.

14.1.1 - Sample Train

Each monitoring station is designed to maintain a sample flow that is clean and efficient and to maintain a consistent temperature for the optimum operation of the 49i analyzer to meet the performance requirements listed in B1. The 49i is housed within purpose-built thermostatically controlled shelters for housing monitoring instrumentation. These shelters are insulated with a combined 9000 BTU Mini Split Air Conditioner Heat Pumps. Other features of the monitoring system include:

- Inlet made of ¼" FEP tubing,
- Inlet filter system made up of a Savillex 47mm PFA filter assembly with a 47mm PTFE filter membrane with pore size of 1 to 2 microns,
- Nafion™ dryer to avoid water condensing in the sample line due to proximity to the coastline, and
- A rain shield installed to protect the sample inlet from taking in precipitation. The sample inlet is below the rain shield.

Upon installation and then once per year an Appendix E Siting Check is performed by the FT under the direction of the FTL. Inlets and sample lines are inspected, the residence time calculated. The ELN Template for the Appendix E Siting Check is listed in Element 25.

14.1.2 - FEM/FRM

Ensuring that the 49i follows the specifications listed in B1 ensures that the hourly averaged and 8-hour running averages of ozone concentrations are comparable to all other FRM/FEMs that monitor ozone across the United States. If the current analyzer needs to be replaced, efforts will be directed to find the same model; if this is not possible, another FRM/FEM will be purchased and this QAPP revised.

14.2 - Data Acquisition System (DAS)

SAAP uses AirVision Software and 8872 hardware as the major piece of its DAS. The 8872 has been set up to communicate with the 49i and T700U/146iQ via Modbus through ethernet. The 8872 collects the ozone concentration and associated diagnostics in 3-second intervals. These records are averaged to one-minute ambient concentrations and diagnostics, allowing us to track critical pieces of information and flag data based on instrument performance. The 8872 runs the AV-Trend software upload the 1-minute data to the AirVision SQL server on the Swinomish server every minute and saves a raw local copy in case of data loss, corruption, or user error. This local raw data is kept for ninety (90) days in 1-minute intervals.

The 8872 is also programmed to control the T700U/146iQ and associated solenoid valves to create specific concentrations and deliver these at specific time intervals to the ozone monitor to minimize data loss. The response of the gas analyzers to these standard gases is then stored in 1-minute intervals and the percent difference is automatically calculated. This is then uploaded to the AirVision SQL server every day and tracked as separate “calibration” data. The raw data is also flagged with AirVision flags to indicate that data should not be considered in any data roll-ups. AV-Trend has many different automatic flags that are applied to the 1-minute data. These are listed in Element 25 Appendix F Table F-1.

The data on the AirVision SQL server can then be accessed through the AirVision Client that acts as a gate to allow data to be retrieved but not accessed directly to ensure security. The FTL or FT can then access the 1-minute data and apply QA/QC flags that apply. These are also listed in Element 25 Appendix F Table F-1. The FTL can then roll-up the 1-minute data into averages through a Data Roll-up function. The P&OM can edit which flags are to be considered null in the Data Roll-up function or reapplied for information purposes.

Based on the roll-up up flags, the FTL (acting as the Level 1 Reviewer) can then apply AQS flags (these are listed in Element 25 Appendix F Table F-2). After the data flags are applied to the 1-hour data, the AirVision software allows the data to be marked as a Level 1 by the reviewer. The FTL will complete their part of the Quarterly Data Report that acts as the L1, L2, and L3 checklist and update the data status to Level 1 for ozone concentration and shelter temperature only. After the Level 2 and Level 3 reviewer completes their sections of the checklist, the data can be marked as Level 2 or Level 3, respectively. After the data is marked as Level 3, the data can no longer be modified.

For more detailed information, see the AirVision Software SOP.

14.3 - Staff Responsibilities

In the table below, tasks are listed by data collection or review task and the staff member(s) responsible for the tasks are marked. In general, the FTL is the main driver of all data QA/QC and oversees the FT, who assists in internal data flagging. The P&OM and SITC IT act as administrators of the AirVision software and thus have duties associated with managing access, settings, and communications.

Table 14-1: Staff responsibilities regarding the data management of O_3 data.

Task	P&OM	FTL	FT	QADR	QAM	SITC IT
Troubleshooting communication issues	X	X	X			
Providing and ensuring connectivity for data collection						X
Modifying AirVision Server or AV-Trend MODBUS communications	X					
Modifying AirVision Server Roll-Up or Flagging settings (null vs descriptive)	X					
User Management for AirVision Client	X					X
Flagging 1-minute data based on QA/QC information		X				
Level 1 Data Review and portion of Quarterly Data Report		X	X			
Level 2 Data Review and portion of Quarterly Data Report				X		
Level 3 Data Review and portion of Quarterly Data Report	X					
In case of dispute between L2 and L3 on data QA/QC, making final call					X	
Uploading Data to AQS	X	X				
Generating AQS reports, Final Data certification	X					

Element 15 - INTEGRITY OF ENVIRONMENTAL INFORMATION (B3)

This element describes your efforts to ensure and maintain the original integrity of EIO described in Element B1.

15.1 - Electronic Lab Notebooks (ELN)

SAAP utilizes a service called LabArchives to keep ELNs. The ELNs allow the FTL and FT to create entries on ELN pages that include notes, tables, images, and even documents. The ELN page comes with the features of tracking who and when an entry is created and the ability to sign a page so that no more edits can be made. The final signed page can then be saved and uploaded to the AirVision Server to ensure all data is kept in a secure location. The pages must be signed within 14 days of the entry being created.

The FTL and P&OM create templates for reoccurring events to ensure critical information is captured. These templates have a manual version tracking that is updated by the FTL and/or P&OM. The P&OM manages the account and staff access to different ELNs. Annually, the P&OM creates new ELNs for each site and downloads the previous year.

For more detailed information, see the Swinomish LabArchives SOP.

15.2 - QA/QC Alerts

To ensure that the data collected can be used for the enforcement of the NAAQS, SITC has increased the interval of ZPS checks from once per 14 days as required by the 40 CFR Part 58 to once per day. This increased frequency allows us to better catch problems in the monitor, DAS, or Multi-Gas Calibration System (MGCS) – the full system that creates the standard test gases for calibration, verification, and ZPS. If any ZPS fails, the AirVision software automatically applies an “out of control” flag on the data that highlights the data in red.

All diagnostics of the instrument (cell A and cell B flows & intensities, instrument temperature and sample pressure) have automatic flags that are applied if the values are outside the operational ranges stated the instrument manual. This, in conjunction with instituting required data checks every 3-4 days, ensures that instrument issues are caught quickly and can be addressed in a timely manner. SITC will implement automatic email alerts to the FTL upon an “out of control” or “outside range” flag being applied to ensure prompt response.

15.3 - CAPs Checks & Filter Changes

Once per week the FT or FTL visit the monitoring location and check the analyzer. This is to visually ensure there are no new flags on the analyzers or the MGCS that are not documented in AirVision. The FTL or FT also checks that the clocks have not gained or lost more than 10 seconds compared to the 8872 as the internal instrument data acquisition is utilized if the AirVision DAS is down for more than one hour. The FTL or FT also inspects the inlets to ensure that there are no issues. Every other week, the CAPs Check is combined with a filter change, subsequent leak check, and filter conditioning to ensure that the regular maintenance does not introduce contaminants into the system. This actions are documented the ELN.

15.4 - Staff Responsibilities

In the table below, tasks are listed by data integrity task and the staff member(s) responsible for the tasks are marked. In general, the FTL is the main driver of all data integrity tasks and oversees the FT, who assists. The P&OM acts as the administrator of the ELN or QA/QC Alerts and thus have duties associated with managing access, settings, and subscription (if applicable).

Table 15-1: Staff responsibilities regarding the data integrity.

Task	P&OM	FTL	FT
Entering actions taken into an ELN	X	X	X
Signing and uploading ELN pages to AirVision		X	X
Managing ELNs; creating new ones and retiring old, user access, subscription payment	X		
Creating and managing ELN page templates	X	X	
Routine CAPs Checks and Filter Changes		X	X
Creating and managing QA/QC Alerts	X		
Responding to the QA/QC Alerts		X	X

Element 16 - QUALITY CONTROL (B4)

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. One function is the control of the measurement process through broad QA activities, such as establishing policies and procedures, developing DQOs, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. The other function is the control of the measurement process through the implementation of specific QC procedures, such as audits, calibrations, checks, replicates, routine self-assessments, etc. QC, as it applies to an AQ monitoring program, is the overall system of technical activities and procedures developed to measure the attributes and performance of the sampling program against defined standards to verify that they meet the stated requirements established by the program. QC includes:

- Establishing specifications or acceptance criteria for each quality characteristic of the monitoring and analytical processes,
- Assessing procedures used in the monitoring and analytical processes to determine conformance to these specifications, and
- Taking any necessary corrective actions to bring them into conformance.

The overall goal of QC is to minimize loss of data through invalidation by establishing a reasonable level of checking at various stages of the data collection process. QC procedures determine if field procedures produce acceptable data and are used to initiate appropriate corrective actions; therefore, QC is both proactive and corrective.

16.1 - O_3 Calibration and Multipoint Verification

The calibration consists of adjustments made to the analyzer at a zero concentration and at an upscale "span" concentration, followed by multi-point verification with three additional verification points spaced along the calibration scale. To be clear, verification does not adjust the analyzer response, just verifies that the analyzer response is consistent with the standard over a specific range. In this way, the verification scale represents the operating range of the analyzer and is inclusive of one-point QC (precision) and span checks. Multi-point verifications are required on a specific interval, while calibrations are not.

16.1.1 - Calibration Requirements/Recommendations

Calibration of continuous O_3 monitors, including adjustment of the zero and span values in the analyzer's internal calibration curve, are **required** as follows:

- Upon initial installation,
- Annually,
- Upon relocation,
- when a Level 1 span or one-point QC check exceeds ± seven %, and
- Before and after replacement of a major component (or components) of an analyzer.

Best practice would be to complete a calibration and subsequent verification BEFORE reaching an exceedance of the Level 1 span or one-point QC check to avoid invalidating data. Calibration of continuous O_3 monitors, including adjustment of the zero and span values in the analyzer's internal calibration curve, are **recommended** as follows:

- Upon initial installation,

- Quarterly (if deemed necessary),
- When a Level 1 span or one-point QC check exceeds ± five %, and
- When observing increased response times to ZPS checks or decreasing ZPS results.

16.1.2 - Multipoint Verification

A multi-point verification starts with generating a series of known concentrations (120 ppb, 90 ppb, 70 ppb, 60 ppb, 30 ppb, and zero air) of calibration gas from a Teledyne T700U Dynamic Dilution Calibrator or a ThermoFisher 146iQ Multi-Gas Calibrator. The generated gas is then introduced to the upstream portion of the sample inlet filter holder to make sure the calibration gas runs through the entire sampling line system. A minimum of four non-zero upscale known concentrations across the operating range of the unit are generated to determine each the analyzer calibration linearity. All points of the calibration curve must be within ± 2.1% and slope 1 ± 0.05 of the best-fit line straight line. Any points that do not meet the MQOs defined for the calibration curve should be investigated or repeated immediately before the analyzer is assumed to be ready for ambient data collection.

All the verification data will be collected by the Agilaire 8872 Site Node. Any verification will be triggered manually (at station or remotely) using a preprogrammed sequence by the Agilaire 8872 Site NodeO_3 concentrations, or data points, are recorded by 8872 every minute for 15 to 20 minutes at each point.

If the verification must be done manually, Swinomish has also developed a multi-point calibration and verification template (Ozone SOP listed in Element 25) that automates the calculation process for multi-point calibration evaluation for O_3.

16.2 - O_3 ZPS Checks

ZPS checks are conducted by subjecting the analyzer to a test gas atmosphere at zero and two upscale known test gas concentrations (0 ppb, 70 ppb and 120 ppb). ZPS checks will be programmed to automatically run daily. This ensures that the entire measurement process is within statistical control by checking if our ozone analyzer passes the acceptance criteria listed below in Table 16-1 and again in Table 16-3.

Table 16-1: Ozone ZPS Check Acceptance Criteria

	Value (ppb)	Percent Difference (%D)	Absolute Difference (|D|)	24 hours/14 day Drift (Δ24h / Δ14d)
Zero	0	N/A	±≤ 2.5 ppb	<±3.1 ppb / <±5.1 ppb
Precision	70	≤ ±7%	<±4.9 ppb	<±4.9 ppb
Span	120	≤ ±7%	<±8.4 ppb	<±8.4 ppb

The test gas atmosphere generated for the ZPS check passes through the entire sample train (which includes the sample line, particulate filter, and Nafion™ dryer – the components used during normal sampling operations). At each monitoring station, the 8872 is configured to trigger the ZPS at a specific time (2:46 am), flag the data with "C", gather the 1-minute ozone concentrations of both the analyzer and the L2 photometer (until 3:14 am). At the end of the programmed ZPS check, the 8872 calculates the average analyzer and L2 photometer

responses, %D or |D| and Δ24h, and save the results to the 8872 "Calibration Results". The 8872 is set to flag the analyzer ozone concentration with "T" which means "Out of Control" if the results exceed the acceptance criteria for %D, |D|, or Δ24h.

SAAP will monitor the results of the ZPS checks to ensure that we don't exceed the acceptance criteria by creating "action thresholds" for each of the levels in the ZPS check. The action thresholds are listed in Table 16-2 below:

Table 16-2: Ozone ZPS Check Action Thresholds

	Value (ppb)	**Percent Difference (%D)**	**Absolute Difference (|D|)**	**24 hours/14 day Drift (Δ24h / Δ14d)**
Zero	0	N/A	±≤ 2 ppb	<±2.1 ppb / <±4.1 ppb
Precision	70	≤ ±5%	<±3.5 ppb	<±3.5 ppb
Span	120	≤ ±5%	<±6.0 ppb	<±6.0 ppb

If the monitor exceeds the action threshold or fails to meet acceptance criteria (is "out of control"), the cause will be investigated, and the monitor will be recalibrated if needed. This investigation will be documented in the ELN through a Corrective Action Form (CAF). The ELN page will be uploaded to the AirVision Database as a PDF once the CAF is complete. A template CAF is listed in Element 25.

The decision-making and validation process for daily ZPS checks is shown in Figure 16-1. There are four main kinds of failures:

1. An issue with the automated system;
2. Action threshold verified as exceeded
3. Acceptance criteria verified as exceeded
4. No confidence in the ZPS check

If #1 or #2 occur, the subsequent investigation should be documented thoroughly any issues identified and how they were resolved in the CAF. If no major changes are made, manually trigger a ZPS check to either replace the missed check or document the improvement.

If #3 and #4 occur, the investigation needs to be followed by a Corrective Action Report (CAR) as there could be a cascade of investigations that occur over many days and/or ELN pages. This should include the type of failure, summary of actions completed, range of data invalidated, list of relevant ELN pages, final passing QA/QC action. A template CAR is listed in Element 25.

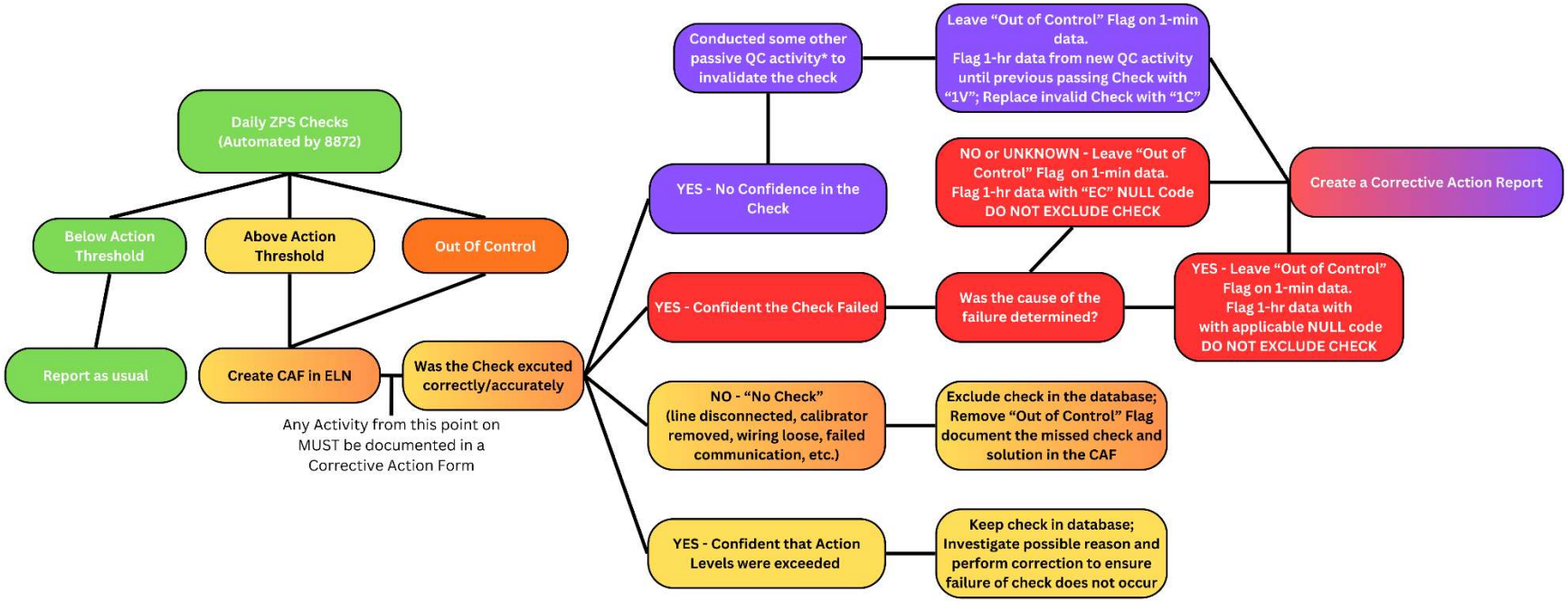


Figure 16-1: Decision-making and validation process for daily ZPS checks

Table 16-3: QA/QC summary for O_3 monitoring.

Type of Check	Purpose of Check	Minimum Frequency	Acceptance Criteria
Routine instrument checks and preventive maintenance	Verifies and documents operational status indications of analyzer and support equipment. Includes performance of routine preventive maintenance in accordance with instrument-specific needs and schedules.	Weekly	Monitor-specific criteria established for operating status indicators
ZPS checks	Used to assess the precision and bias of the data based on variability of responses over time. Confirms analyzer response is within established control limits. NOTE: No adjustments to the analyzer will be made with automated or remote testing.	Bi-weekly (GOAL: The monitoring system is designed to automatically perform and report the results of ZPS checks daily)	Zero point: drift by <±3.1 ppb (24 hr) AND <±5.1 ppb (24 hr – 14 day) difference Non-Zero Points: ≤ ±7% of True value or < ± 1.5 ppb which ever greater Precision (70) drift = <±4.9 ppb Span (120) drift = <±8.4 ppb
Multi-point verification	Establishes and/or verifies linear calibration relationship between known test gas concentrations and analyzer responses across the measurement range. NOTE: multi-point verifications will be performed only manually on-site; verifications will NOT be performed using automated or remote access methods.	Upon adjustment, repair, installation, moving, repair and recalibration of standard of higher level. one/365 days and one/calendar year	All points ≤ ±2.1 % or ≤ ±1.5 ppb difference of best-fit straight line whichever is greater, and slope is 1± 0.05
Annual performance evaluation audit	Confirms precision & bias assessments of measurement data.	During ozone season, one/365 days and one/calendar year	EPA audit levels 4-10: percent difference ≤ ± 10.1% EPA audit levels 1-3: difference of ≤ +1.5 ppb or ≤ ± 10.1% percent difference, whichever greater Audit concentrations at a minimum of three levels not including zero.
National Performance Audit Program	Confirms precision & bias assessments of measurement data.	100 % of PQAO sites every six years, and at least 20% of PQAO sites audited each year	EPA audit levels 4-10: percent difference ≤ ± 10.1% EPA audit levels 1-3: difference of ≤ +1.5 ppb or ≤ ± 10.1% percent difference, whichever greater Audit concentrations at a minimum of three levels not including zero.
Technical Systems Audit	Reviews the quality system (system which implements the QAPP) for suitability and effectiveness	Every 3 years	A simple description of the Acceptance Criteria is not possible. This would be determined by the Auditor at the time of Audit.

16.3 - Annual Performance Evaluations

The Annual Performance Evaluation of a single analyzer must be completed annually during O_3 season. The Annual Performance Evaluation is performed by either a state or local partner or third party contractor with no affiliation with SITC. Audit concentrations will be determined based on ambient concentrations during the current monitoring quarter and must be within the acceptance criteria defined previously in Table 6-4 and in Table 16-3 of this Element.

The audit levels are defined for O_3 in 40 CFR Part 58 Appendix A 3.1.2.1 as:

Table 16-4: Annual Performance Evaluation levels for O_3 (ppm).

Audit Level	O_3(ppm)
1	0.004-0.0059
2	0.006-0.019
3	0.020-0.039
4	0.040-0.069
5	0.070-0.089
6	0.090-0.119
7	0.120-0.139
8	0.140-0.169
9	0.170-0.189
10	0.190-0.259

The lowest level must be within two to three times the analyzer detection level (0.005 PPM for EQOA-0880-047), which corresponds to level two. The second point will be less than or equal to the 99th percentile of the data at the site or the network of sites in the Primary Quality Assurance Organization (PQAO) or the next highest audit concentration level (currently levels five or six). The third point can be around the primary NAAQS level or the highest three-year concentration at the site or the network of sites in the PQAO (levels four or five).

16.4 - Federal Audits

An audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives. There are two major federal audits of NAAQS monitoring sites: National Performance Audit Program (NPAP) and Technical Systems Audit (TSA). Swinomish is a PQAO for reference in the following sections. Further information is included in Element 20.

16.4.1 - National Performance Audit Program (NPAP)

The NPAP is a type of audit where quantitative data are collected independently to evaluate the proficiency of an analyst, monitoring instrument, or laboratory. The NPAP is required for 100 % of PQAO sites every six years, and at least 20% of PQAO sites audited each year. The NPAP is completed by the EPA Region 10 or a regional contractor. Audit concentrations are determined by the NPAP operator at the time of audit and based on the same requirements as the annual performance evaluation audit levels. The monitor response must be within the acceptance criteria defined previously in Table 6-4 and in Table 16-3 of this Element.

16.4.2 - Technical Systems Audit (TSA)

The TSA is the type of audit that reviews the quality system for suitability and effectiveness. TSAs are required to be completed every three years for PQAOs. TSAs are completed by the EPA Region 10. TSAs should focus on the broad picture of the monitoring organization as a whole. This can include but is not limited to:

- Monitoring data review and validation
- QA process and documentation
- Maintenance and repairs
- AQS submittal
- Ambient air monitoring sites

A TSA is not solely a data review, document review, or a series of performance evaluations; rather, it is a conglomerate of activities that should verify that an organization has met its overall quality system requirements, as dictated by 40 CFR Part 58 App A and the organization's QA documents (DMP, QAPP, and SOPs), and has produced, and is producing, quality data.

16.5 - Staff Responsibilities

In the table below, tasks are listed by QA/QC task and the staff member(s) responsible for the tasks are marked. In general, the FTL is the main driver of all data QA/QC events and oversees the FT, who assists. The P&OM acts as the overseer of all the automatic programing of ZPS checks and the decision maker for what is the appropriate maintenance or action post exceedance of the acceptance criteria or action levels.

Table 16-5: Staff responsibilities regarding quality control.

Task	P&OM	FTL	FT
Programing the calibrator and DAS for automated ZPS checks	X	X	
Checking that the daily ZPS checks are passing		X	X
Determining Corrective Actions to take in the event of an exceedance of an Action Level or Acceptance Criteria	X	X	
Documenting exceedances of Acceptance Criteria or No Confidence in the Check in a Correct Action Report	X	X	
Implementing Corrective Actions and Documenting in CAF	X	X	X
Ensuring appropriate QA/QC Activities are completed post-Corrective Actions	X		

Element 17 - INSTRUMENTS/EQUIPMENT CALIBRATION, TESTING INSPECTION, AND MAINTENANCE (B5)

17.1 - Instrument Calibration

The instruments that require calibration or verification/reverification for this QAPP include:

- Teledyne T700U Multi Gas Calibrator with L2 Bench Photometer
- Thermo Scientific Instrument 146iQ Multi Gas Calibrator with L3 Field Photometer
- Alicat Flow Meter 0-20 LPM (MBS-20SLPM-D-BT)
- Alicat Flow Meter 0-100 sccm (MBS-100SCCM-D-BT)
- Alicat Flow Meter 0-10 sccm (MBS-10SCCM-D-BT)
- Thermo Scientific Instrument 111iQ Zero Air Generator
- Teledyne T701 Zero Air Generator
- EcoTech (now acoem) 8301 Compressed Air Source
- Thermo Scientific Instrument 49i Ozone Analyzer

The details on the calibration/verification and other QA/QC activities for the Thermo Scientific Instrument 49i Ozone Analyzer are explained in the previous element. This section will focus on the instruments used to create the test atmosphere or verify the flow rates (a.k.a. Standards). The plumbing configuration, solenoid valve power, and verification procedures of the MGCS are described in the Multi-Gas Calibration System SOP.

17.1.1 - Traceability of Photometer

Ozone is not a gas that can be bottled and stored; instead, it has to be made. To create the test atmospheres that are used in the ZPS checks, calibrations of multipoint verifications, a calibrator with a UV lamp to produce ozone must include a photometer (see EPA-454/B-22-003 “Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone”). To ensure that SAAP has traceability to a Level 1 Standard Reference Photometer (SRP), SAAP will have two photometers: a Level 2 (L2) Bench and a Level 3 (L3) Field Photometer. The lines of verification/reverification for these two reference photometers is shown in Figure 17-1.

The L2 Bench photometer in the T700U will be sent to the California Air Research Board’s (CARB’s) Standards Lab or regional standard reference photometer annually. The first trip will be to verify the photometer as a L2 Bench, subsequent trips will be for reverification. The frequency and requirements of the verification/reverification are listed in Table 17-1. In general, the T700U will be used to conduct the ZPS checks of the O3 analyzer.

The L3 Field photometer in the 146iQ will be verified and reverified in house pre/post ozone season. The requirements of the verification/reverification are listed in Table 16-3. In general, the L3 Field photometer will be used as a back-up if the T700U is unavailable.

17.1.2 - Zero Air Check

Unlike ozone, zero air can be bottled; however it is expensive, needs replacement often, and is not as good as zero air generated by a Zero Air Generator (ZAG). To ensure that our ZAG is providing dry zero air free from the pollutants of interest, SAAP keeps a “Standard” ZAG that

is not used for the ZPS checks – and Ecotech 8301. Annually or post a sediment change, the ZAG at each station will be compared to the Standard ZAG. The frequency and requirements of the zero air check are listed in Table 17-1 where the supplies are listed in Element 18.

17.1.3 - Mass Flow Meters

Ubiquitous standards of an air monitoring program are mass flow meters. The flow rates of the analyzer and standard instruments are important pieces of information that can diagnose issues or indicate correct function. SAAP has three (3) different gaseous mass flow meters for the ranges of 0 – 20 SLPM, 0 – 100 sccm, and 0 – 10 sccm. These are routinely used to check the internal mass flow controllers in the T700U and 146iQ for other SAAP QAPPs. For this QAPP, the routine check of the internal mass flow meters are not listed as MQOs in Table 6-4; however, they are auxiliary standards to be utilized if necessary. The mass flow meters are verified by the manufacturer. The frequency and requirements of the manufacturer reverification are listed in Table 17-1.

Table 17-1: Instrument Calibration/Verification/Reverification summary

Standard	Type of Check	Purpose of Check	Minimum Frequency	Acceptance Criteria
T700U Level 2 Photometer	Verification and reverification	Verification of photometer to Level 1 photometer as a Level 2	Annually	Verification: Each point difference < ± 3.1% (or ± 1.5 ppb for concentration points < 50 ppb). Three (3) regression slopes = 1.00 ± 0.03 & intercepts = 0 ± 3 ppb. Standard deviation of the three (3) slopes < 0.0075 and the three (3) intercepts < 1.00 ppb Reverification: Each point difference < ± 3.1% (or ±1.5 ppb for concentration points < 50 ppb). One (1) regression slope from the reverification test cycle must be within ±0.015 of the mean slope and the intercept be within ±1.5 ppb from the most recent verification test. Regression slope from the reverification test cycle = 1.00 ± 0.03 and intercept = 0 ± 3 ppb
146iQ Level 3 Field Photometer	Verification and reverification	Verification of photometer to SRP as a Level 2	Six month (Pre- and post- O_3 season)	
T701 & 111iQ Zero Air System	Zero air check	Verification of zero air generation against a second "standard" zero air generator (ZAG) Ecotech 8301	Annually; or after sediments changed	Concentrations of Level 2 photometer are <±1 ppb from Standard ZAG
Alicat Flow Meter 0-20 LPM	Verification and reverification	Ensure NIST traceability of Flow Controllers if needed to test instrument or Standard flow rates	Annually	±0.8% of reading and ±0.2% of full scale (Manufacturer Service)
Alicat Flow Meter 0-100 sccm	Verification and reverification	Ensure NIST traceability of Flow Controllers if needed to test instrument or Standard flow rates	Annually	±0.8% of reading and ±0.2% of full scale (Manufacturer Service)
Alicat Flow Meter 0-10 sccm	Verification and reverification	Ensure NIST traceability of Flow Controllers if needed to test instrument or Standard flow rates	Annually	±0.8% of reading and ±0.2% of full scale (Manufacturer Service)

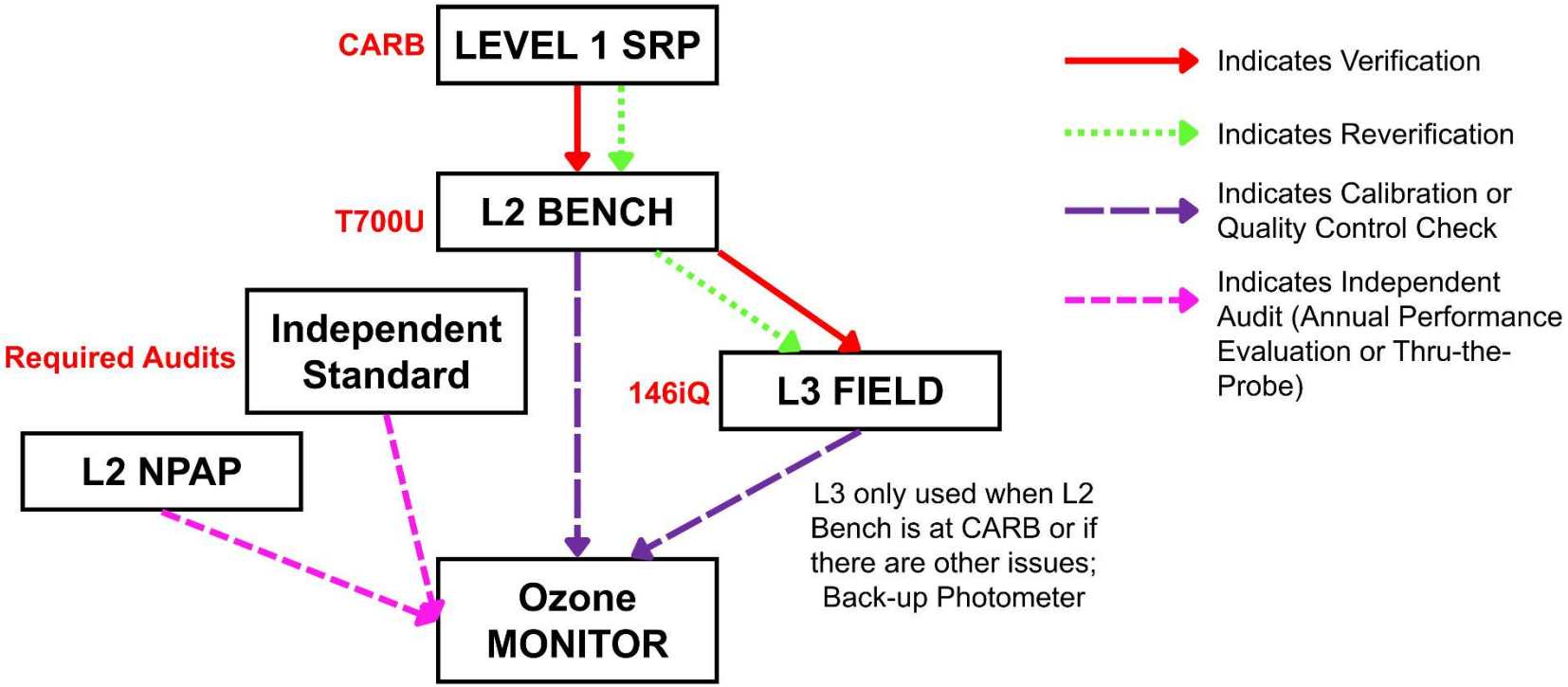


Figure 17-1: Photometer Traceability Pathway

17.2 - Testing & Inspection

This section describes the procedures used to verify that all instruments and equipment are maintained in sound operating conditions and are capable of operating at acceptable performance levels.

Initial testing of each piece of equipment is conducted by SAAP at the installation site of the Level 2 Bench Photometer for operation within the manufacturer's specifications. This includes at least a multi-point verification with a short sample train and subsequent testing of the sample train and automated ZPS system. The diagnostics will be inspected and the sample flow verified. Leak check completed.

17.3 - Maintenance & Inspections

Following the routine checks and maintenance schedule, as outlined in Table 17-2, it is necessary to avoid contamination and ensure the instruments are operating properly.

Table 17-2: 49i O_3 analyzer routine maintenance activities.

Activity	Frequency	Comments
CAPs Inspection	Weekly	Inspect instruments for flags, inspect inlets and sample lines
Replace inlet filter	Biweekly	Turn instrument off, disassemble filter holder, replace filter, reassemble filter holder, turn on instrument, leak check after 30 minutes, condition filter with 150 ppb of O_3
Clean sample inlet	Annually; as needed	Disassemble and clean; reassemble OR replace
Flow calibration/ verification	Biannually; as needed	Following pneumatic system maintenance (e.g., replacing capillaries)
Replace filter holder	As needed	If leak check with external filter fails and leak check without external passes
Rebuild sample pump	As needed	When leak check fails (pressure does not drop below 250 mmHg after 20 seconds) when no leak is expected
Check Flow through Nafion™ dryer	Quarterly	Use Alicat (0-20 SLPM) to check flow through Nafion™ dryer.
Replace Nafion™ dryer inlet filter	As needed	When discolored or when flow drops due to filter. (Tested by replacing filter)

Activity	Frequency	Comments
Replace Nafion™ dryer	Annually	Every 2 years or if the dryer becomes discolored, or inner/outer tube is obviously cracked
Rebuild Nafion™ pump	As needed	When flow drops through Nafion™ dryer not due to filter.

17.4 - Staff Responsibilities

In the table below, tasks are listed by traceability, inspection, and general maintenance task and the staff member(s) responsible for the tasks are marked. In general, the FTL is the main driver of all inspections and general maintenance events and oversees the FT, who assists. The P&OM acts as the overseer of all the traceability events and routine tasks are completed.

Table 17-3: Staff responsibilities regarding instrument or equipment traceability and/or maintenance.

Task	P&OM	FTL	FT
Scheduling Traceability or photometers and ZAGs	X		
Sending/installing calibration equipment pre/post verification		X	X
Performing in-house traceability actions on photometers and ZAGs		X	X
Ensuring in-house traceability is accurate and documented appropriately	X	X	
Complete initial inspections and verifications of diagnostics	X	X	X
Completing routine inspections and checks		X	X
Completing routine maintenance		X	X
Ensuring routine inspection and maintenance is completed	X	X	
Document routine maintenance and inspections/checks		X	X

Element 18 - INSPECTION/ACCEPTANCE OF SUPPLIES AND SERVICES (B6)

In this section the supplies and services required for this QAPP will be described. The equipment and supplies associated with this QAPP are stored in a simple inventory.

18.1 - Supplies

Spare parts and consumables will be obtained from the original equipment manufacturer if possible and will be located at the SAQMS or at the SITC DEP office.

18.1.1 - ZAG Scrubbers

To create a reference point and clean air for O_3 generation, a zero-air cylinder or ZAG are required for ZPS checks and multi-point verifications. Due to the cost of storing zero air and known contamination protentional of zero-air cylinders, it is better to use a ZAG. The ZAG scrubbers are consumable and must be replaced. These consumable scrubbers and frequency of replacement are listed below in Table 18-1.

SAAP has three models of ZAGs: Thermo Fisher 111iQ, Teledyne T701, and an Environics ZAG that is used for back-up OR as a standard for comparison purposes for a zero air check. The ZAG models match the multi-gas calibrator model at the SAQMS.

Table 18-1: ZAG scrubbers.

Model of ZAG	Consumable	Model Number	Estimated Change Out Time
Thermo Fisher 111iQ	Purafil (media, chemical filter, bottled)	7075	Yearly or Discolored
	Charcoal (charcoal, bottled)	4158	Yearly
Teledyne T701	T701 maintenance kit (Includes charcoal, Purafil, molecular sieve, o-rings, etc.)	015980000	Annually

18.1.2 - Nafion™ Dryer

Per the 2021 technical memo on “Use of Nafion™ Dryers for Ultraviolet (UV) Ozone Analyzers” the EPA’s then titled Office of Research and Development recommended and provided technical assistance to install an external Nafion™ dryer if the UV O_3 analyzer did not have an internal dryer. SAAP includes an external Nafion™ dryer because of the proximity of the SAQMS to the shoreline, which ensures elevated relative humidities for the majority of the year. The Nafion™ dryer helps reduce noise and increase the response time of the UV O_3 analyzers. The consumables and interval of replacement for the upkeep of the Nafion™ dryer are listed in Table 18-2.

Table 18-2: Nafion™ dryer consumables.

Consumable	Model Number	Est. Change Out Time
Air inlet filter (Parker – Balston)	9933-05-DQ	Monthly or as Needed
Thomas model # 107CA18 rebuild kit	SK107B	Annually
Perma Pure Nafion™ tube	# MD-110-48P-4	As Needed or when damaged

18.1.3 - 49i Ozone Monitor

The consumables and interval of replacement for the upkeep of the 49i ThermoFisher Scientific Ozone Monitor are listed in Table 18-3.

Table 18-3: 49i ozone monitor consumables.

Consumable	Model Number	Est. Change Out Time
Omnipore (or similar brand) PTFE membrane filter (47 mm), pore size < 2.5µm	JAWP04700	Biweekly or as needed
49i consumable spare parts kit (pump rebuild, capillaries, fuse, etc.)	112457-00	Annually or as needed/ As Needed
PTFE ¼" outer diameter		Inspected Annually/ Change as Needed
Three-way PTFE Solenoids		As Needed
Rain Shield		As Needed
External Filter Housing		As Needed

18.2 - Services

Services for this project are wide ranging. Services include free data access and model computational power as well as the service to ensure traceability of SITC standards or have an external non-SITC affiliated annual performance evaluation.

18.2.1 - Traceability Services

The exact traceability services required are described previously in Section 17. The FLT is responsible for ensuring that the traceability services have been completed.

18.2.2 - Annual Performance Evaluations

SAAP will either contract with an external contractor to perform an in season Annual Performance Evaluation or work with the local AQ agencies (like the Northwest Clean Air Agency or NWCAA) that can loan SITC equipment and/or staff to perform the external Annual Performance Evaluations. The P&OM is responsible for ensuring that the Annual Performance Evaluation services have been completed.

18.2.3 - HYSPLIT Model

In the event of an exceedance of the NAAQS, the P&OM will look at external data and models to determine the best course of action. The models and external data are described in the following three sections. In general, the best practice for making decisions about the

source of O_3 precursors and the elevated levels of O_3 itself would be to use multiple weather models to capture uncertainty in model performance. In and around the Swinomish airshed, orography is incredibly important to pollutant transportation. Thus, thus resolution closer to one to -four km is much more desired than 0.25 degree intervals of larger global models.

18.2.3.1 - Model Description

The National Oceanic and Atmospheric Administration (NOAA)'s Air Resource Laboratory (ARL) provides access to computing servers to run HYSPLIT model. With NOAA registration comes access to the dispersion version of the model that calculates the position of thousands of particles released at specific times using a user chosen weather model. This model can be run forward or backwards in time. This cloud of particles then represents the likely volume in space the modeled release either travels to or originates from.

The online HYSPLIT portal allows the user to select the weather model of choice. SAAP will utilize the HRRR Model. The following is an overview of HRRR model specifications:

1. The Rapid Refresh model is the continental-scale NOAA hourly-updated assimilation/modeling system operational at the National Centers for Environmental Prediction (NCEP). RAP covers North America and is comprised primarily of a numerical forecast model and an analysis/assimilation system to initialize that model.
2. The HRRR model is a NOAA real-time three 3km resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three km grids with three km radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour1-h period, adding further detail to that provided by the hourly data assimilation from the 13 km radar-enhanced RAP. Figure 18-1 depicts the three -km range of the continental U.S. region with the radars marked in open circles. This is solely to depict range.
3. The Advanced Research Weather Research and Forecast (WRF- ARW) model utilizes 51 vertical full-ETA levels.
4. Forecasts of up to 18 hours are produced every hour and posted on the HYSPLIT site for use.

18.2.3.2 - Model Selected

The HRRR is the highest resolution model for the continental U.S. that is available in the HYSPLIT ARL web portal for the entire year. Occasionally, there will be smaller regions of higher resolution available, but this is mostly during wildfire season. This web portal is important as it allows instantaneous use. It does not require the user to download the weather model output or submit computations to a user owned computer. It utilizes free NOAA-provided computing power and outputs modelling result in instantly viewable versions and full model results that can be processed via programming languages, such as Python.

18.2.3.3 - Model Use

HYSPLIT dispersion trajectories will be used to determine most probable locations of atmospheric transport during emergency release event by tracking the locations of 10,000

non-decaying particles released from the locations of the stacks. This information will be used in conjunction with real-time data and other models to predict trends in concentrations of pollutants (i.e., will increase, remain the same, or decrease) over the course of the next hour, two hours, three hours, etc.

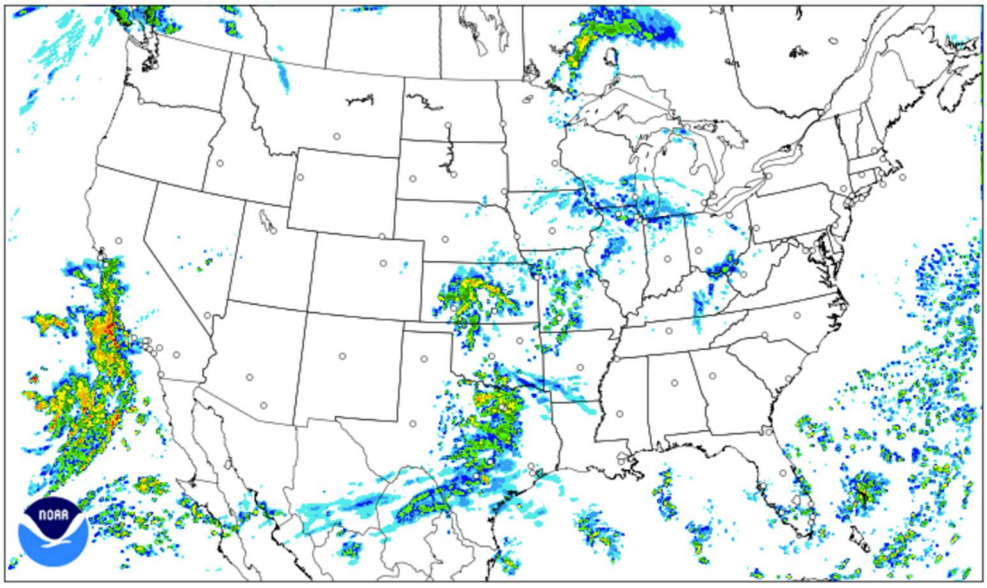


Figure 18-1: HRRR three km continental U.S. domain with reflectivity and radars marked with open circles.

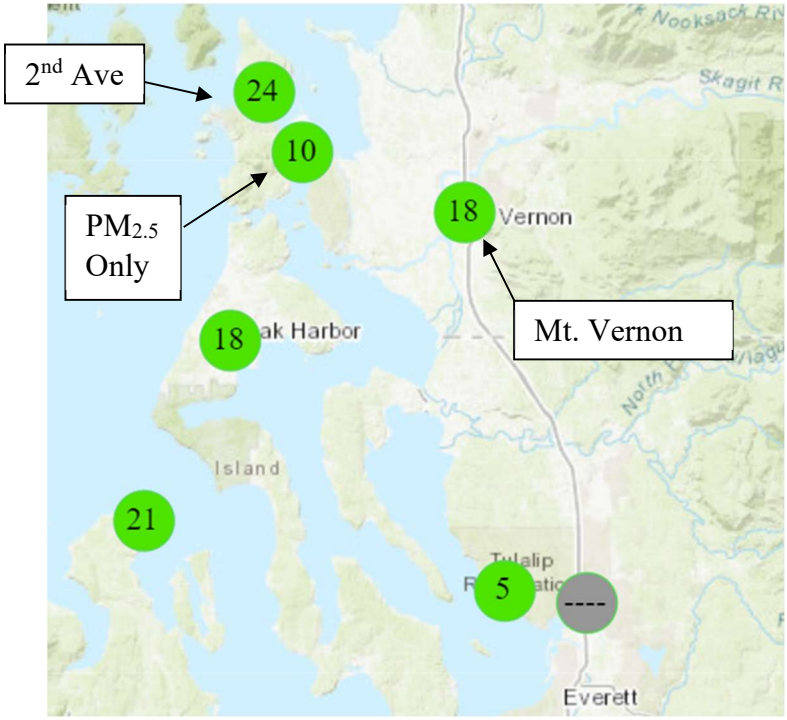


Figure 18-2: Locations of O_3 monitors at 2nd Avenue and Mt. Vernon sites on the WA Department of Ecology's interactive map.

18.2.4 - NWCAA and WA Department of Ecology Monitoring

During an a violation of the NAAQS, the P&OM will look at the NWCAA and WA Department of Ecology's monitoring posted at https://enviwa.ecology.wa.gov/home/map, which allows view the hourly concentrations O_3 at the 2nd Avenue and Mt. Vernon sites (see Figure 18-1). This will help to monitor the extent of the release and if the winds are shifting toward the Reservation (i.e., if concentrations are high starting at 2nd Avenue then at Bartholomew Road). Questions about data quality and real-time measurements can be obtained from NWCAA staff through contacting Evan Bing (evanb@nwcleanairwa.gov).

18.3 - Staff Responsibilities

In the table below, tasks are listed by inventory or service task and the staff member(s) responsible for the tasks are marked.

Table 18-4: Staff responsibilities regarding the associated supplies and services.

Task	P&OM	FTL	FT
Maintaining an inventory of supplies			X
Procurement of supplies from the instrument manufacturer or scientific equipment supplier		X	X
Report the status of all spare parts and consumable items (quarterly) to P&OM			X
Ensuring funding exists for the needed on-hand supplies	X		
Inspecting supplies; comparing them to previous parts/supplies and inspecting for deviations	X	X	
Planning and scheduling external traceability services; processing payment		X	X
Scheduling and ensuring Annual Performance Evaluation is completed	X		
Executing, evaluating, and analyzing model output	X		
Downloading, evaluating, and analyzing external nearby NAAQS monitoring data	X		

Element 19 - ENVIRONMENTAL INFORMATION MANAGEMENT (B7)

This section of the QAPP discusses the management of project documents and data records. These have both been touched on previously in Elements 12, 14, and 15. This section provides an overview of the management of these documents and records by SAAP.

19.1 - Project Documents

Project documents that are not data records are created as either guidance documents or reports. Table 5-1 lists the different assessments, frequency, and responsible party that are tied to guidance documents and reports. Table 19-1 below includes the documents that are created during the assessment.

Table 19-1: Non-Data Record Documents

Assessment Type	Assessment Agency	Document
QAPP review and updates	SITC	• Current QAPP • Renewal QAPP Checklist, • Communications with EPA • final version of updated QAPP
SOP review and updates	SITC	• Associated ELN templates • reference tables • final version
SMP review and updates	SITC	• Appendix E siting check • Associated SOPs • final version
DMP review and updates	SITC	• Associated SOPs • final version
QDR (Level 1-3 Checklist)	SITC	• Quarterly Data Report (QDR) • Data export in AQS format • Corrective action reports • Associated ELN pages • AQS Quarterly Reports (AMP251, AMP350 and AMP430)
Annual data certification	SITC	• Traceability documentation for standards • Certification Letter to EPA • AQS Reports (AMP256, AMP600, AMP504, AMP450, AMP450NC)
TSA	EPA R10	• TSA result report • Corrective action reports
NPAP	EPA R10 designated contractor	• NPAP result report • Corrective action reports
Annual performance evaluation	SITC	• Annual performance evaluation results, • Corrective action reports

19.2 - DAS

The process of capturing data from the analyzer is known as data acquisition, whereas the organization of the data is known as data management. Within these areas, QA activities and data reviews must be carried out to verify the adequate quality of the data. A governing principle is that sufficient thoroughness and time taken in data management would allow someone else (e.g., an auditor) to reconstruct final reported values (reports to the public, EPA quarterly reports, etc.) and traced back to the original raw data to convey evidence and rationale for the data's validity or invalidity. This information must be available months or years after the data records are gathered, which requires a rigorous and consistently followed system and documentation.

19.2.1 - Data Acquisition

The AirVision software package and 8872 are the O_3 analyzer data acquisition system (DAS). The 8872 has a specific software called AV-Trend that controls the collection of data from the 49i through MODBUS communication over a shared ethernet switch. The data is requested via a Modbus command and received in three second intervals. The raw data is recorded as one-minute averages and rounded to prescribed precision based on the parameter settings in AV-Trend. This includes the O_3 concentration and diagnostics of:

- Flows through cells A and B,
- Intensities in cells A and B,
- Instrument bench temperature,
- UV lamp temperature, and
- Sample pressure.

The 49i has an internal DAS that records hourly averages as a back-up that can be accessed through a ThermoFisher Software iPort. The details of data recording are detailed in the Swinomish DMP and the AirVision Software SOP. This will be updated yearly to include any changes or updates to the data storage system.

19.2.2 - Data Transmittal

Data transmittal is accomplished using a direct fiber connection to the Swinomish Network. The 8872 then syncs with the AirVision Server and updates the AirVision SQL database that resides on the Swinomish servers. This connection is protected within the Swinomish Network and managed by Swinomish IT department.

Occasionally, there may be a need to download data from the 49i using the iPort software to connect via Ethernet. These are saved to the personnel's computer and transferred to the SITC network as a back-up. Electronic files of the raw data record are archived "as is." SITC will only alter the name of raw data files; under no circumstances will raw data be altered. Any edited data will remain separate and saved in specific places. See "Swinomish Data Management Plan" for more details on the procedures of data transmittals.

The AirVision software can be programmed to auto alert via email based on thresholds that any parameter exceeds. SITC will utilize this function for diagnostics that are critical for operation of a NAAQS monitor (e.g., total flow in the instrument must be between one and three LPM) or exceedance of the NAAQS or other action levels discussed in Element 7 of this QAPP.

19.2.3 - Security

Security of data is ensured by the following controls:

- SITC network is only accessible via user assigned access that must be requested by the Director of DEP.
- AirVision server can only be accessed by AirVision client software that can only be downloaded by Swinomish IT with permission of the P&OM.
- Username and password for AirVision client access. Only DEP staff with a username and password generated by P&OM can access the AirVision client.
- Server and individual computer password changes (quarterly for continuing personnel; passwords for outgoing personnel will be cancelled immediately)

19.3 - Data Validation

The AV-Trend software on the 8872 allows for Level 0 data validation by automating flagging if a value exceeds the operational criteria, is in a QA/QC check (flagged as "C"), or if an automated ZPS check or verification fails. This will result in an "Out of Control" flag ("T") applied until the failure is addressed. The second step of data validation is manual, in which the FTL and FT look through the one-minute data and add or modify the flags using AirVision preset flags and SAAP-created flags. The third step is a manually triggered roll-up where AirVision rolls up the one-minute data to hourly average data and checks that at least 75 % of the hour is complete. Only "good" data are used to create the hourly averages. If the hour is not complete, the data are flagged, and (75% of the hour or 45 minutes are good). Some one-minute flags are passed up to the one-hour values to provide a description of what is occurring in that hour. These resulting one-hour flags are then used by the FTL and FT to apply hourly AQS flags.

The use of status flags in performing data validation is addressed in DMP, and procedures for verifying and validating data are referenced in Element 23 of this QAPP. After data are flagged as questionable (either by status flags by the Level 0 reviewer), Level 1 and 2 reviewers (identified in Element 4) evaluate the flagged data to identify underlying causes and decide whether the data are valid. If the data are invalid, they are not used in calculations and are not included by AirVision if flagged appropriately in the one-minute data. If the data are valid but qualified due to some extenuating circumstance, then the data will be used in calculations, accompanied by a qualifier and comment documenting the situation.

If the DQIs identified in Element 7 do not meet the prescribed MQOs, data are deemed invalid back to the previous acceptable check. Invalid data are disqualified from the data set and consequently, not used in averaging calculations. Details of the data verification and validation process are summarized in Element 23 of this QAPP. Explanations and/or justifications for invalidating data or retaining questioned data will be included in any reports that are submitted to EPA.

19.4 - Data Storage and Retrieval

Retaining copies of all electronically recorded data sets provides a data audit trail. This allows data reduction and validation operations to be performed while retaining the integrity of the raw data set. Photos and/or PDFs of the eLogbook pages which include all templates for ZPS checks, etc. are created and signed within 14 days of the visit and filled in with raw tables of

QC data from the datalogger. These are automatically updated to the LabArchives cloud, which is the service providing eLogbook space and software accessible via ethernet or phone. The LabArchives cloud includes the ability to view the complete revision history for any eLogbook entry, including attachments. LabArchives maintains comprehensive logs and file backups in physically redundant locations to ensure research integrity. Annually, the ELNs are uploaded to the SITC server, which does not include the revision history. ELNs will not be deleted from LabArchives until at least five years have passed. Individual LabArchive pages are printed and uploaded to the Logbook Editor in AirVision for consolidation of records. Site documentation is reviewed as part of the data validation process.

If there are data files generated outside of the AirVision database, these files are manually copied to \\SITC2\ and duplicated to create a read-only copy as back-up. Read-only copies are saved in a separate part of \\SITC\ and will not be used as the basis for analysis to avoid editing raw data. Data is stored in the onsite data logger with the eventual update of having automatic downloads occurring in the future. Reports and site records are saved directly to the SITC server and are backed up daily automatically by the SITC IT Department. The P&OM will develop a read function for the 49i export format to ensure that the 49i monitor data is uploaded to the AirVision database. A final validated dataset will be prepared in AirVision as previously stated. Any small changes to this process (e.g., which one-minute automatic flag is used, how email alerts are generated, etc.) will be detailed in the most recent Swinomish DMP.

GROUP C: ASSESSMENT, RESPONSE ACTIONS AND OVERSIGHT

Element 20 - ASSESSMENTS AND RESPONSE ACTIONS (C1)

An assessment for this QAPP is defined as an evaluation process used to measure the performance or effectiveness of the quality system for a monitoring network, its sites, and various measurement phases. The results of assessments indicate whether the QC efforts are adequate or need to be improved. As used here, "assessments" is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

Performance Evaluation Audits provide vital information regarding the status of the project measurement operation and how well the measurement data adhere to the quality specifications of the QAPP. Performance audits are conducted following the guidance documents in the "EPA Quality Assurance Handbook" series, Volumes I and II.

To ensure the adequate performance of the quality system, SAAP will perform or participate in the following assessments:

- QAPP review and updates
- SOP reviews
- SMP review and updates
- DMP review and updates
- Quarterly data review
- Annual performance evaluation
- Annual data certification
- NPAP
- EPA TSA

Table 6-1 provides information on the parties implementing assessments and their frequency.

An audit is a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

20.1 - Critical Documentation Review and Updates

To ensure that the guidance and supporting documents are accurate and reflect the true status of the SAAP, the P&OM, FTL, and FT will review and update as necessary the:

- QAPP
- SMP
- DMP
- Relevant SOP

This review and updates will happen before the O_3 season begins (May 1) to ensure that EPA R10 is aware of any changes to QA/QC procedures, sampling location, database, etc. Best practice would give 6 months for review starting in December before O_3 season.

The SMP and DMP are updated biannually. Currently, the SMP is similar to the state-required Network Review and State Implementation Plan ("Monitoring Networks" portion) that are

updated every five years or annually, respectively. The underlying goal is to determine how well a particular monitoring network is achieving its required air monitoring objectives, and how it may need to be modified to continue to meet its objectives. This might include relocating monitors due to changed traffic patterns, construction, growth of foliage on trees, etc. Our goal with the SMP is to start creating documentation that can hopefully become a formal Network Review.

The SMP update starts with the annual siting and residence time assessment completed by the FT and FTL. This assessment is an on-site visit that includes re-measuring of the physical distances and observations to determine consistency with the requirements, such as height above ground level, distance from trees, paved or vegetative ground cover, etc. The FT will update photographs at N, NE, E, SE, S, SW, W, and NW that are more than a year old. The P&OM reviews the result of the FT's site assessment as well as the stated objective for each monitoring location evaluates whether those objectives can still be attained at the present location. The P&OM and FTL will draft the SMP with the aforementioned information finalized upon review by the QADR and the QAM. If there is a site wavier, the waiver is included in the SMP and will be renewed every five years.

The DMP does not act in a similar manner as the Annual Network Plan but instead should encompass any data validation processes that would be audited during a TAS.

20.2 - Quarterly Data Report

A template Quarterly Data Report (QDR) is listed in Element 25.

The FTL and FT complete the L1 checklist portion of the QDR after reviewing all the one-minute data, applying the appropriate Swinomish flags to the 1-minute data, rolling up the 1-minute data to 1-hour data, and assigning the appropriate AQS flag to the one-hour interval data in AirVision. In general, the appropriate 1-minute and 1-hour flagging should be completed on a weekly to monthly basis; instead of waiting till the end of the quarter, data cleaning and flagging occurs twice weekly on 1-minute data and the hourly data is finalized monthly.

Any instances of data nullification or data qualification are listed and explained in the QDR for the use of the Level 2 reviewer. The QADR completes the L2 checklist portion of the QDR and approves the data in AirVision as a Level 2 Reviewer. In addition to use by the QADR, the QDR is used to give a presentation to Environmental Science branch of Swinomish DEP to highlight instrument malfunctions, data quality concerns, and other news.

After the completion of the L2 portion of the QDR, the P&OM reviews the data in AirVision and completes the L3 potion of the QDR for the final Level 3 approval. The QDR is thus complete and acts as the final data validation report. Data is approved as Level 3 in AirVision (locking the ability to change the 1-hour data). All data for the quarter is exported in AQS format from AirVision and then uploaded to AQS by the FTL. The P&OM finally assesses the data to ensure all the data has made it through the upload process and into AQS; if not, the FTL is alerted to correct any issues. The P&OM accomplishes the quarterly completeness assessment by running the AMP430 Completeness Report, the AMP350 Raw Data Report and the AMP251 QA Data Report. The P&OM compares the data in AQS with the data that should be in AQS based on the monitoring schedule. The P&OM archives the AMP251, AMP350 and AMP430 reports used for the quarterly completeness review on the Swinomish server.

Upon completeness of the AQS reports, an email is sent to the EPA Region 10 Quality Assurance Monitor. If the monitor does not meet 75 % completeness (in one month or over the entire quarte) or if there are findings within the other AQS reports, the P&OM includes in the email to EPA R10 information on what occurred and what actions SAAP plans to take to keep the event from reoccurring.

20.3 - Annual Performance Evaluations

As previously described in Element 14.5, the annual performance evaluation of a single analyzer must be completed annually during O_3season. The annual performance evaluation is performed by either a state or local partner or third-party contractor with no affiliation with Swinomish. If an analyzer exceeds audit limits at any level, an immediate ZPS check will be performed to verify audit results. If confirmed, data will be invalidated back to the point of the last acceptable QC check or a known point of analyzer malfunction, and a corrective action report will be initiated to investigate and remedy the cause of failure. If the audit results cannot be confirmed, no data validation action will take place; a second audit would need to be completed as soon as possible and preferably during O_3 season.

The audit results will be saved on the Swinomish network and imported into AirVision for data retention and integrity.

20.4 - Annual Data Certification

In accordance with 40 CFR Section 58.15, the EPA requires an annual air monitoring data certification letter to certify that the regulatory data collected by the FRM and FEM monitors at the O_3 sites during O_3 season (May 1 to September 30) of the previous year, meet the criteria in 40 CFR Part 58, Appendix A. Along with the certification letter, the P&OM must submit to EPA an annual summary report of all the ambient AQ data collected by the monitors, as well as a summary of the precision and accuracy data, for the previous year.

Data certification is the final process of assessing the O_3 monitoring data for the previous calendar year. The SAAP verifies and validates data monthly, as discussed in Element 22. Additionally, the P&OM or designee assesses the data on a quarterly basis when the FTL generates specific AQS reports to assess the DQIs as discussed in Element 20.2. With these assessments ongoing throughout the year, annual data certification then serves as the last assessment of the data – looking at it from an all-inclusive, annual perspective – to see if any unidentified anomalies or trends exist in the data that the quarterly review process did not previously identify. The annual data certification process starts with running and reviewing AMP reports contained in AQS. The reports typically queried include the following:

- AMP350 Raw Data
- AMP251 QA Data
- AMP430 Data Completeness
- AMP600 Certification Evaluation
- AMP256 Data Quality Indicator
- AMP504 Extract QA Data
- AMP450 Quicklook Criteria Parameters
- AMP450NC Quicklook All Parameters

The FTL and P&OM review these reports and confirm everything is complete and accurate. The FTL and P&OM also review the reports to ensure the statistical results indicate the

monitoring data were in control over the course of the O_3 season and met the DQOs. If they identify problems, the FTL and/or P&OM investigate them in accordance with Element 24.

Ultimately, this process verifies that the monitoring data submitted to AQS are correct and complete. Once the FTL and P&OM complete any necessary corrections, additions, or deletions in AQS and the FTL and P&OM have finalized the dataset, the P&OM officially recommends the data for certification to EPA R10. The data certification package provided to EPA includes a signed copy of the AMP600 report, along with a letter signed by the QAM and P&OM, certifying that the ambient concentration and QA data in AQS are complete and accurate, taking into consideration the QA findings, to the best of their knowledge.

The annual data certification package is due to EPA R10 by May 1 of each year.

20.5 - NPAP

In general, the NPAP is a performance evaluation where quantitative data are collected independently to evaluate the accuracy of the monitoring equipment. In EPA R10, a mobile laboratory arrives at a the SAAP O_3 monitoring site and generates known concentrations of O_3 audit gases used to challenge the on-site O_3 analyzer.

SAAP addresses performance evaluation activities for the O_3 monitoring network by participating in the EPA's NPAP as described in 40 CFR Part 58, Appendix A, Sections 2.4 and 3.1.3. Only qualified and authorized personnel execute performance audits. See Tables 6-1 and 7-2 for information regarding the frequencies and acceptance criteria related to NPAP audits. The NPAP program audits 20 % of an agency's sites per year and each site every six years. Since SITC has one site, the EPA will audit the site every year. The EPA reports the NPAP results directly to the FTL after the audit is completed. If a monitor does not pass the evaluation, the P&OM and FTL will take appropriate action to identify why the monitor failed the evaluation and to correct the situation. The NPAP audit results are also reported to AQS by the EPA or its support contractor(s).

20.6 - EPA TSA

An EPA TSA is a thorough, independent and systematic on-site qualitative assessment, where EPA auditors examine facilities, equipment, personnel, training procedures, protocols, and record keeping for conformance with the regulatory requirements and this QAPP. The EPA R10 QA staff conduct a TSA of SAAP every three years, in accordance with 40 CFR Part 58, Appendix A, Section 2.5. The EPA reports its findings to the QAM and P&OM. The P&OM regularly monitors progress on corrective actions required because of the TSA findings and communicates progress to the SAAP staff, QAM, the Director of DEP, and EPA R10.

An EPA TSA team, made up of individuals from EPA R10 or an individual TSA auditor, may segregate TSA activities into two categories. The auditors may audit these categories independently or together. The TSA categories are:

- Field activities: monitor installation, calibration, and sampling
- Data management activities: collecting, flagging, editing, and uploading data; providing data security

During the audit, the auditors will interview key personnel with responsibilities for planning, field operations, equipment certification, QA/QC, data, and document management and reporting.

Upon completion of the audit, EPA verbally alerts the P&OM, QAM, and DEP Director of any deficiencies or findings during an on-site TSA exit briefing. This briefing allows SAAP staff to begin formulating or implementing corrective actions. The EPA typically distributes a draft TSA report within 30 days of the completion of the audit. EPA R10 allows a brief comment period of the draft report for factual accuracy. After EPA receives comments from SAAP, EPA finalizes the TSA report and resubmits the report to the P&OM, QAM, and DEP Director. The P&OM, QAM, and DEP Director must complete and submit to the EPA R10 within 30 days a formal response to address the TSA findings. The P&OM, QAM, and DEP Director will communicate with EPA routinely after submitting the corrective action plan to provide progress updates on a periodic basis until SAAP has completed the corrective actions.

Element 21 - OVERSIGHT AND REPORTS TO MANAGEMENT (C2)

The following table lists the reports, the producer of the report, the receiver of the report and the report frequency.

Table 21-1: List of reports, the producer, the receiver, and the frequency (with due date) of the reports.

Report	Producer	Receiver	Frequency; due date
QDR 1) L1 Checklist Complete 2) L2 Checklist Complete 3) L3 Checklist Complete	1) FTL and FT 2) QADR 3) P&OM	1) QADR 2) P&OM & Environmental data section (includes Director of DEP) 3) QAM & EPA R10 QAM	1) One/quarter, 1st Monday of 2nd month of quarter 2) One/quarter, 1st Monday of 3rd month of quarter 3) One/quarter; after quarterly data report, within 21 days
• AMP350 Raw Data • AMP251 QA Data • AMP430 Data Completeness	P&OM	EPA R10 through AQS	One/quarter; 90 days after quarter ends
EPA quarterly reports	P&OM, FTL	Carl Brown	One/quarter; 30 days after quarter ends
SITC DEP annual reports	P&OM and FTL	Director of DEP; Presentation to DEP; highlights included in annual presentation to Swinomish Senate	One/year; 120 days after year ends
• AMP600 Certification Evaluation • AMP256 Data Quality Indicator • AMP504 Extract QA Data • AMP450 Quicklook Criteria Parameters • AMP450NC Quicklook All Parameters	P&OM	EPA R10 through AQS	One/year; 90 days after year ends
EPA annual reports	P&OM	Carl Brown	One/year; 90 days after year ends
NPAP audit results	EPA R10	SITC	One/year
TSA results	EPA R10	SITC	One / three years

21.1 - Quarterly Data Report

The QDR should compile all instances of data nullification or data qualification. This acts as the Level 1, Level 2, and Level 3 Data Verification/Validation Checklist for Ozone. As shown

in the previous table, there are three steps to completing the QDR: Level 1 Review (FTL or FT), Level 2 Review (QADR), and Level 1 Review (P&OM).

The first QDR draft documents that the Level 1 Reviewer:

- Reviewed daily for anomalies and completeness; note if missing data was acquired.
- Verified that all daily precision checks fall within acceptable ranges.
- Invalidated data collected during an hour where the shelter temperature was not within the acceptable range.
- Reviewed pass/fail of automated nightly ZPS checks.
- Reviewed any and all corrective actions performed.
- Assessed data and document values or outliers outside of the acceptable ranges.
- Reviewed any exceedances and resulting actions.
- Flagged data as necessary for further investigation.
- Apply necessary AQS codes for hours in which maintenance or calibrations (or similar events) were occurring.
- Document that all electronic lab notebook pages have been uploaded to the AirVision database.

The second QDR review documents that the Level 2 Reviewer:

- Reviewed site records (operator logbook, site logbook).
- Reviewed operator checks (leak checks, filter changes, maintenance).
- Assessed data for values or outliers outside of the acceptable ranges.
- Reviewed Level 1 reviewers used consistent reasons for data invalidation throughout the monitoring period to indicate calibrations, audits, etc.
- Flagged any inconsistencies, anomalies, or systemic issues. Approved on addressing issues from the Level 1 Reviewer.
- Verified that all daily ZPS checks fall within acceptable ranges.

The final review of the QDR documents that the Level 3 Reviewer:

- Ensured the proper null codes are used.
- Ensured the Level 1 and Level 2 data reviewers bracketed all invalidated data with the appropriate void codes and the correct checks of analyzer accuracy.
- Ensured all data falls within the acceptable ranges as stated in the MQOs in Table 7-4.
- Ensured all data is acceptable and can be used for its intended purpose.
- Reviewed one-minute data as needed when completing the Level 3 review procedures.
- Added informational AQS flags describe data that is out of the ordinary but may be considered “valid.”
- Provide the final validation signature.

GROUP D: DATA VALIDATION AND USABILITY

Element 22 - ENVIRONMENTAL INFORMATION REVIEW (D1)

Data review is the in-house examination to ensure that the data has been recorded, transmitted, and processed correctly. It includes completeness checks to determine if there are any deficiencies such as missing data or lost integrity. The Level 1 to Level 3 reviewers should compare the data under evaluation to actual events, as per guidance (Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8)). When QC checks indicate that the data fail to meet the acceptance criteria, the data is nullified or qualified per subsequent troubleshooting or corrective actions suggest. Level 1 to Level 3 reviewers shall flag data identified as suspect, or that does not meet the acceptance criteria, with AQS codes prior to upload to AQS.

Data verification is the process for evaluating the completeness, correctness, and conformance/ compliance of the data set against method, procedural and contractual specifications. Verification can be further defined as confirmation, through provision of objective evidence, that specified requirements for that type of data have been fulfilled.

Data validation is a routine process designed to ensure that reported values meet the quality goals of the environmental data operations. Data validation is further defined as examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. The primary intended use for the SAAP O_3 data set is NAAQS compliance. A progressive, systematic approach to data validation must be used to ensure and assess the quality of the data. Data validation includes the review of the SAAP O_3 data sets against the O_3 MQOs (Table 7-2). Reviewing data long-term (over a monthly or quarterly period) provides information about the structure of the data and may identify patterns, relationships or potential anomalies. If any SAAP staff find a problem or discrepancy, they will conduct further investigations to find the source of the error and then correct it. Deviations from operational procedures or QA requirements that do not result in data invalidation may require that data be qualified with QA qualifier flags prior to upload to AQS.

22.1 - Sampling Design

Sampling network and monitoring site selection are based on the following where applicable:

- 40 CFR Part 58, Appendix D - Network Design Criteria for Ambient Air Quality Monitoring
- 40 CFR Part 58, Appendix E - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring
- 40 CFR Part 58, Appendix G – Uniform Air Quality Index (AQI) and Daily Reporting
- Guideline on Ozone Monitoring Site Selection EPA-454/R-98-002

The location of each SAQMS O_3 monitoring site has received EPA approval; thus, data from each O_3 monitor will be considered spatially representative as long as the O_3 sites continue to meet the requirements set forth in 40 CFR Part 58, Appendix E and in this QAPP.

The SAAP staff shall thoroughly document any deviations from the minimum siting criteria (e.g., shelter location, probe placement and/or monitor sight path requirements) in the quarterly data report and/or the SMP. Examples of deviations include but are not limited to insufficient distance from roadways (i.e., marginal terrain criteria) and insufficient distance from influencing objects (e.g., dripline of an adjacent tree or a cell phone tower installed after the monitoring site was established).

22.2 - Monitor Operating Procedures

Element 11 outlines required monitoring operation procedures. SAAP uses O_3 monitors that are designated as FRM or FEM; thus, the methodologies and technologies are considered acceptable for regulatory use. The Agilaire 8872 SiteNode routinely identifies potentially unacceptable data points in the database through electronic application of AirVision status flags. The P&OM has associated each parameter from the O_3 analyzer and QA/QC equipment with an acceptable range of values that trigger automated flagging. The Level 1 reviewers routinely review the AirVision status flags as part of the data validation process. This activity assists in identifying suspect or potentially bad data points that could invalidate the resulting averaging periods.

The DMP includes all AirVision Flags and the associated AQS flags as well all AQS flags with notations to which kind of measurement they can be applied to.

The SAAP staff must document any deviation from the established data collection plan in the electronic lab notebook. Accurate and complete documentation of any data collection deviations will assist in any subsequent investigations or evaluations.

Data collection procedures must adhere to those procedures documented in the SOPs listed Element 26. EPA and internal auditors verify adherence to data collection procedures and the associated SOPs during EPA TSAs. Any time the SAAP staff use a code to void or flag data, they should document the reason for using the code in the QDR. Accurate and complete documentation of any flagged or voided data will assist in any subsequent investigations or evaluations.

22.3 - QC

Element 14 specifies the QC activities that are to be performed during the ambient monitoring program. These include calibrations, verification, ZPS checks, and audits which provide indications of the quality of data being produced by specified components of the measurement process. The procedure, acceptance criteria, corrective action, and changes should be specified for each quality control check. Data validation should document the corrective actions that were taken, monitoring days that were affected, and the potential effect of the actions on the validity of the data.

This paragraph lists the criteria and describes how SAAP will handle QA/QC data and associated O_3 concentration data. SAAP will:

- Code missing O_3 data with appropriate AQS null codes,
- Invalidate hourly O_3 data when less than 45 minutes of an hour of valid data are collected,
- Invalidate O_3 data if the FRM/FEM shelter temperature requirements are not met,

- Bracket valid O_3 data with valid, one-point QC checks that meet the MQOs/control limits,
- Invalidate O_3 data back to the most recent valid, passing one-point QC check and also forward to the completion of appropriate corrective actions and calibration when a valid one-point QC check exceeds critical criteria,
- Report all valid QA/QC data to AQS, with valid one-point QC checks that exceed acceptance criteria reported with the "1F" null code, and
- Report invalid one-point QC checks with the "1C" null code.

22.4 - Calibration

Element 16 addresses the calibration of the O_3 monitors along with the information that should be presented to ensure that the calibrations are performed correctly, and the results are acceptable. When calibration problems are identified by a Level 1 Reviewer, any data produced between the suspect calibration event and any subsequent recalibration should be flagged to alert data users.

22.5 - Data Reduction and Processing

As mentioned in the above sections, the EPA will perform TSAs and the FTL, QADR, and P&OM will complete the associated sections (L1, L2, and L3) to complete the QDR. This final QDR acts as final data validation report to ensure Level 1 and Level 2 data reviewers follow the data reduction and processing activities mentioned in the QAPP. The Level 1 data reviewers will review data monthly and quarterly to ensure that associated flags or any other data qualifiers have been appropriately associated with the data. The QADR and P&OM will review the data quarterly to ensure that the SAAP staff took the appropriate corrective actions.

22.6 - Exceptional Events

Although exceptional events for O_3 are rare, this section describes what is involved regarding requesting an exceptional event exclusion. The regulations at 40 CFR Section 50.14 allow the EPA administrator to exclude certain data from use for determinations of exceedances and violations of the NAAQS, so long as a state or local agency demonstrates to the administrator's satisfaction that the exceedance or violation was caused by an "exceptional event." The regulations at 40 CFR Section 50.1 define an "Exceptional Event" as an event or events, in which:

- The resulting emissions affect AQ in such a way that there exists a clear causal relationship between the specific event(s) and the monitored exceedance(s) or violation(s),
- The event(s) is not reasonably controllable or preventable, and
- The event(s) is caused by a human activity that is unlikely to recur at that location or is a natural event(s).

An exceptional event does not include:

- Air pollution relating to source noncompliance,
- Stagnation of air masses or meteorological inversions, and

- Meteorological events involving high temperatures or lack of precipitation.

Conditions involving high temperatures, or a lack of precipitation may promote occurrences of some types of exceptional events, such as wildfires or high wind events, which do directly cause emissions.

The EPA does not consider data impacted by an exceptional event "representative" of AQ for NAAQS comparison purposes or the calculation of certain summary statistics. The Level 3 reviewer should flag all concentration data impacted by an exceptional event with an AQS null code linked within AQS to an event description. The Level 3 reviewer should add exceptional event codes and descriptions to AQS during the quarterly data review, or as soon thereafter as possible, but no later than the schedule established by federal rulemaking.

It is the responsibility of the P&OM with the assistance of the EPA R10 staff and AQ forecasters to analyze the data for potential exceptional events and to add the necessary flags and descriptions into AQS by the applicable regulatory due dates.

To obtain concurrence with an exceptional event, the P&OM must notify and cooperate with EPA R10 to prepare a demonstration package for the EPA administrator. When the P&OM submits a demonstration package, the FTL will change the informational flags in AQS to request exclusion flags.

Exceptional event data in AQS must receive concurrence from the EPA administrator. Data that does not receive a concurrence is still eligible for NAAQS comparisons, regardless of the application of request exclusion flags.

Element 23 - USEABILITY DETERMINATION (D2)

To set probability limits on decision errors, the SAAP should 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 and is 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, prior to issuing any final reports, the following categories of questions will be evaluated and documented.

SAAP uses a coefficient of variation between samples to determine acceptability and ensure quality control. The MQOs and associated acceptance criteria are outlined in Table 7-2.

Data verification is the process of checking and documenting that the data are what they are supposed to be. This is done by verifying the SOPs were followed and the records are complete. Data validation is a combination of checking data processing operations have been carried out correctly and that it is representative of the intended population. Additionally, it should be useful to answer the questions the project is designed to answer.

The different stages of data review are outlined in the Swinomish DMP. Database verification uses the limits which are detailed in this QAPP in Table 7-4 as conditions that cause qualifiers or flags to be added to that record. Flags never overwrite numerical data stored in the database and are very different from final null value codes, which also never overwrite original data, but signify that record is not to be used in reports or charts. Flags denoting error conditions, suspect hourly fluctuations, out of range values, etc. are saved as separate, unique fields in the database. This way it is possible to recover the original data.

The requirements for valid data are described in Element 14. The critical requirements listed in Table 7-4 under “Critical Criteria” apply to every record of data. If any particular data point does not meet each and every criterion listed, that point should be invalidated unless there are compelling reasons and justification for not doing so. Such a determination would be made and documented carefully. The concentration or time period for which one or more of these criteria are not met is invalid until proven otherwise. The cause of not operating in the acceptable range for each of the violated criteria must be investigated, corrected, documented, and minimized to reduce the likelihood that additional data will be invalidated.

The operational requirements listed in Table 7-4 under “Operational Criteria” 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. When appropriate, outside consultation (local P&OM agencies and the EPA) is sought to add to the evidence supporting validity.

Systematic criteria listed in Table 7-4 under “Systematic Data” 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 necessarily invalidate any individual data.

The QDR will be used to document the verification and validation process. The template for QDR was created based on EPA templates for Level 1 and Level 2 verification reviews and Level 3 validation reviews. These templates are attached in Element 26.

23.1 - Validating Exceedances

In the event of an O_3 exceedance at an O_3 ambient AQ monitor, the FTL will take appropriate action to review the data and the operation of the monitor to ensure the exceedance is valid.

If a monitor records an exceedance, the P&OM will notify the QAM and DEP Director. SAAP staff may need to do preliminary investigations to ensure some type of exceptional event did not affect the monitor. The SAAP staff will document any information acquired and upload to the AirVision database as a logbook page with the data to demonstrate the exceedance was truly valid or that it was potentially due to an exceptional event.

23.2 - Quantitative

The following questions are posed during the final data review process, at least annually, by the FTL, the QADR, and the QAM. Results are documented on an ongoing basis in the quarterly reports to the community and to EPA. Major findings are presented to the funding agency as they become apparent (e.g., modifying site locations or sampling frequency).

- Do the results of monitoring indicate a measured concentration consistently far above, far below or near the action levels (O_3 NAAQS)? For example, if SAAP data show consistent values near the standard, we may want to investigate an additional monitoring site in another location.
- Were SAAP action limits set at the correct levels?
- Is the data more or less variable (ranges high and low, by day, month, and season) either in time or in space than expected, and found at other, relevant comparison sites? If so, this may indicate that the sampling frequency or sampling network may need to be increased or decreased.
- Do the monitoring data and/or circumstances indicate that monitoring is not necessary? Does the information provided by monitoring shed light on the issues faced by the community? Should monitoring be conducted at a different location?
- Have the correct amount of resources been allocated to monitoring? For example, if schedules have not been met, should more resources be assigned to staff or training?
- Are there developments that may impact monitoring or QA design (e.g., technological developments, new buildings in the area, or changes in roads or traffic)?
- Are there any other changes to the quality assurance system or monitoring design that would better support the goals of the program?

23.3 - Qualitative

Element 23 is required to address how the program plans to evaluate the measurement goals and continuously improve. The MQOs under evaluation are listed in Table 7-4 for O_3. This section of the QAPP will outline the procedures the SAAP will follow to determine whether sampling procedures are producing data that comply with the DQOs as well as other factors that affect the usability of the data and what actions are taken as a result of the assessment process.

The quality assurance reports are reviewed, basic summary statistics are calculated, and the data are plotted and evaluated. Common sense is applied to assess how well the data conform to expectations. Unexpected data (for that season, time of day), missing values, and any deviations from standard operating procedures are reviewed. This is a qualitative review. The SAAP will generate some summary statistics by quarter and year. The summary statistics are number of samples, mean concentration, standard deviation, coefficient of variation, maximum concentration, and minimum concentration at each site by quarter and year.

There may be reasons to assess changes in the system, including:

- New information on health impacts becomes available that can be used to modify SAAP action limits.
    - For example, when Federal or Washington State policies are updated, SAAP may want to ensure that internal reporting policies stay consistent with the most recent information.
- New monitoring objectives are outlined that require changes to standards.
    - For example, integration of new sample locations, and inclusion of different monitoring equipment to expand understanding of the photochemistry.

There also may be recent developments (since the last data validation process, usually quarterly) that can affect the study design including, but not limited to:

- A new monitoring instrument preferable to the method currently used becomes available,
- EPA guidance is updated,
- The Swinomish community expresses heightened interest,
- SAAP forms a partnership with nearby air monitoring agencies who can assist with independent assessments, data review, etc.
    - For example, do SAAP want to add an additional monitor to better capture the ambient conditions (total VOCs) or atmospheric chemistry rates (incident ultra-violet light)?

Other QA considerations include:

- Is there a preventable condition causing data to be unusable or lost?
- Were the QC criteria (Table 7-4) used to validate the data appropriate to meet DQOs?

Element 24 - REFERENCE LINKS

24.1 - Scientific Papers:

Jaffe, Dan, et al. "Transport of asian air pollution to North America." *Geophysical Research Letters*, vol. 26, no. 6, 15 Mar. 1999, pp. 711–714, https://doi.org/10.1029/1999gl900100.

Langford, Andrew O., et al. "An unusual winter ozone event in Colorado." *Journal of Geophysical Research: Atmospheres*, vol. 130, no. 14, 26 July 2025, https://doi.org/10.1029/2025jd043695.

Liang, Q., et al. "Summertime influence of Asian pollution in the free troposphere over North America." *Journal of Geophysical Research: Atmospheres*, vol. 112, no. D12, 11 May 2007, https://doi.org/10.1029/2006jd007919.

Lin, Meiyun, et al. "Transport of Asian ozone pollution into surface air over the western United States in Spring." *Journal of Geophysical Research: Atmospheres*, vol. 117, no. D21, 17 Feb. 2012, https://doi.org/10.1029/2011jd016961.

24.2 - Federal or State Code

Code of Federal Regulations, eCFR updated daily, link to 40 CFR Part 58.

OSHA 1910 Table Z-1, Limits for Air Contaminants.

WAC 173-460-150, Washington Code.

24.3 - Federal Guidance & Technical Documents

Ambient Monitoring Guidelines for the Prevention of Significant Deterioration (PSD), EPA 450/4-87-007, May 1987

Best Practices for Review and Validation of Ambient Air Monitoring Data, EPA-454/B-21-007, August 2021

Conducting Technical Systems Audits of Ambient Air Monitoring Programs, November 2017

EPA Requirements for Quality Assurance Project Plans, (QA/R-5) EPA/240/B-01/003, March 2001)

Guidance for Preparing Standard Operating Procedures (SOPs), (EPA QA/G-6) EPA/240/B-01/004, March 2001

Guideline on Ozone Monitoring Site Selection, EPA-454/R-98-002, August 1998

List of Designated Reference and Equivalent Methods, December 2025

NIOSH Pocket Guide to Chemical Hazards, Ozone, CDC, October 30, 2019

QA Handbook Ambient Air Monitoring Volume I: Ambient Air Quality Monitoring Program, EPA-600/R-94/038a, April 1994

QA Handbook Ambient Air Monitoring Volume II: Ambient Air Quality Monitoring Program, EPA-454/B-17-001, January 2017

QA Handbook Appendix D Validation Templates, March 2017

Quality Assurance Project Plan Guidance, EPA IT/IM directives, February, 2025.

Technical Note – Clarifications and Guidance on Residence Time Determination, June 2019.

Technical Note - Use of Electronic Logbooks for Ambient Air Monitoring, April 2016

Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone, EPA-454/B-22-003, January 2023

Use of Nafion Dryers for Ultraviolet (UV) Ozone Analyzers, EPA Memorandum, February 2021

24.4 - State-Level Reports/Guidance Documents:

Washington Department of Ecology Ambient Air Monitoring QAPP (SAAP used the previous version of this QAPP, 2021-2026, as a reference in drafting this document. That version can be obtained upon request).

Washington Department of Ecology Ozone Monitoring SOP

North Carolina Department of Environmental Quality Ozone Ambient Air Quality Monitoring QAPP

24.5 - Additional Reference Links:

Teledyne API T700 Dynamic Dilution Calibrator Manual

Teledyne API T701 Zero Air System Manual

Thermo Fisher Scientific 49i Ozone Analyzer Manual

Thermo Fisher Scientific 146iQ Multi-Gas Calibrator Manual

Thermo Fisher Scientific 111iQ Zero Air Supply Manual

8301-Series Compressed Air Source Manual (EcoTech, now Acoem)

Element 25 - APPENDICIES

The following documents may be made available upon request and have been reviewed by EPA Region 10.

25.1 - Appendix A – Training Log Asana Project Example

25.2 - Appendix B – LabArchives SOP

25.3 - Appendix C – AirVision Software SOP

25.4 - Appendix D – Management of Air Quality Files and Data Records SOP

25.5 - Appendix E – ELN Template Page for the Appendix E Siting Check

25.5.1 - Residence Time Determination Calculator Template

25.6 - Appendix F – Data Flag Tables F-1 and F-2

25.7 - Appendix G – Ozone Monitoring SOP

25.8 - Appendix H – Corrective Action Form Template

25.9 - Appendix I – Corrective Action Report Template

25.10 - Appendix J – Multi-Gas Calibration System SOP

25.11 - Appendix K – Inventory Template

25.12 - Appendix L – Quarterly Data Report Template