Swinomish Indian Tribal Community
Department of Environmental Protection
11430 Moorage Way - LaConner, WA 98257 - 360.466.7280 - 360.466.1615 fax

QUALITY ASSURANCE PROJECT PLAN

CONTINUOUS MONITORING OF

Sulfur Dioxide (SO_2) and Hydrogen Disulfide (H_2S)

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

9/12/2024

Prepared by Kelsey Larson, Caitlin Roberts, and Wyatt Tanner

Category 2 QAPP

PROJECT MANAGEMENT (Group A)

Element 1 - TITLE AND APPROVAL (A1)

X Todd Mitchell
Environmental Director

X Nicole Casper
Water Resources Manager

X Kelsey Larson
Kelsey Larson
Air Quality Analyst I

X Caitlin Roberts
Caitlin Roberts
Air Quality Specialist I

X Wyatt Tanner
Wyatt Tanner
Air Quality Technician I

X Shannon B. Stewart
Shannon B. Stewart
Quality Assurance Data Reviewer

X Fields, Cindy Digitally signed by Fields, Cindy Date: 2024.09.25 13:47:01 -07'00'
Cindy Fields
EPA R10 Quality Assurance Manager

X DESTINY HOLLOWED Digitally signed by DESTINY HOLLOWED Date: 2024.09.25 13:09:37 -07'00'
Destiny Hollowed
EPA Grant Manager

Element 2 - CONTENTS

2.1 - **Figures**

2.2 - **Tables**

2.3 - **Acronyms & Abbreviations**

AQ – Air Quality
AQSp – Air Quality Specialist
AQT – Air Quality Technician
ASIL – Acceptable Source Impact Level (From Washington State Code)
CAP – Criteria Air Pollutant
CAS # - Chemical Abstracts Service Registry Number
CDC – Center of Disease Control
CFR – Code of Federal Regulations
CV – Coefficient of Variation
DEP – Department of Environmental Protection
DOE – Washington's Department of Ecology
DQF – Data Quality Flags
DQO – Data Quality Objectives
EC – Estimated Long-term Concentration Exposure
EMC – Environmental Compliance Manager
EPA – Environmental Protection Agency
EPA R10 – EPA's Region 10 made up of WA, OR, ID and AK.
GFS – Global Forecasting System
HAP – Hazardous Air Pollutant
HQ – Hazard Quotient
HRRR – High-Resolution Rapid Refresh Model
HYSPLIT – Hybrid Single-Particle Lagrangian Integrated Trajectory
IRIS - Integrated Risk Information System
ITEP – Institute for Tribal Environmental Professionals
MDL – Measurement Detection Limit
MQOs – Measurement Quality Objectives
MRL – Minimum Risk Levels
NAM - North American Mesoscale Forecast System
NEI – EPA'S National Emission Inventory
NCEP – National Centers for Environmental Prediction
NIST – National Institute of Standards and Technology
NOAA – National Oceanic and Atmospheric Administration
NRMC – Northwest Regional Modelling Consortium
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
ppbv – parts per billion by Volume (Mixing Ratio unit)
ppm – parts per million (Mixing Ratio Unit)
QA – Quality Assurance
QA/QC – Quality Assurance & Quality Control
QADR – QA Data Reviewer
QAPP – Quality Assurance Project Plan
QC – Quality Control
Qyuuqs – Swinomish Local Newspaper
RfC - estimate of a continuous inhalation exposure concentration to people (including sensitive subgroups) that is likely to be without risk of deleterious effects during a lifetime.
SAAMP – Swinomish Ambient Air Quality Program
SAQMS – Swinomish Air Quality Monitoring Station
SITC – Swinomish Indian Tribal Community
SOP – Standard Operating Procedure
TAP – Toxic Air Pollutant (used in Washington State Law)
URE - Inhalation Unit Risk Estimate for Carcinogenic Risk
VOC – Volatile Organic Compounds
WAC – Washington Code (Washington State Regulations)
WRF – Weather Research and Forecast

Element 3 - DISTRIBUTION LIST (A3)

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

Distribution List

Name	Organization	Position	Email
Todd Mitchell	Swinomish Indian Tribal Community (SITC)	Department of Environmental Protection (DEP) Director	tmitchell@swinomish.nsn.us
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Destiny Hollowed	EPA R10	Grants Project Officer	hollowed.destiny@epa.gov

Element 4 - PROJECT ORGANIZATION (A4)

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.

4.1 - **Project Staff and Roles**

The following sections list the responsibilities of each individual in Swinomish Indian Tribal Community (SITC) in the Department of Environmental Protection (DEP):

4.1.1 - DEP Director, Todd Mitchell

Major QA related responsibilities of the Director include:

- Reviewing acquisition packages (contracts, grants, cooperative agreements, inter agency 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

4.1.2 - Water Resources Manager, Nicole Casper

Major QA related responsibilities of the Water Resources Manager 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 16 hours in training by reviewing and understanding this QAPP and all relevant SOPs

4.1.3 - Air Quality Analyst, Kelsey Larson

QA related responsibilities of the Air Quality Analyst (AQA) 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 and revising this QAPP, SOPs, Data and Site Management Plans, and all supporting documents such as 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"
- 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 AQ Program
- Submitting to AQS

4.1.4 - Air Quality Specialist, Caitlin Roberts

QA related responsibilities of the Air Quality Specialist (AQSp) include:

- Carrying out the work in the field in compliance with the data quality objectives (DQOs) and measurement quality objectives (MQOs) of this QAPP.
- Drafting QAPP elements, SOPs, Data and Site Management Plans, 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.
- Ensuring that assessments and audits are scheduled and completed
- Conducting or participating in QA activities
- Tracking the results of QC checks, calibrations, audits, and traceability using Swinomish's AQ database
- 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

4.1.5 - Air Quality Technician, Wyatt Tanner

The Air Quality Technician (AQT) is responsible for:

- Carrying out the work in the field in compliance with the data quality objectives (DQOs) and measurement quality objectives (MQOs) of this QAPP.
- Supporting AQSp to draft SOPs and 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 HAPs data collected, Level 0 for CAPs and WX data that is not completed by the database or DAS.
- Participating in training and certification activities
- Ensures measurement quality standards are met as required in this QAPP
- Following all manufacturer's specifications
- Performing and documenting preventative maintenance
- Documenting deviations from established procedures and methods
- Reporting all problems and corrective actions to AQA
- Entering field collected data into database
- Flagging suspect data

4.1.6 - QA Data Reviewers, Shannon Stewart

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.
- Completing quarterly QA/QC Checklist as an internal auditor
- Reviewing that reviews, assessments and audits have been completed
- Provides reports directly to DEP Director, in the form of data review reports completed quarterly that summarize QC results and any important QC findings, such as those that would cause any data to be suspect or invalidated.

SITC does not have a separate Quality Assurance division. Therefore, the QA Data Reviewer will act as the Quality Assurance Manager (QAM) and objectively assess the data according to the quality indicators included in this QAPP. Shannon Stewart does not participate in the raw data collection or Quality Control/Quality Assurance activities related to the collection or flagging of Air Quality data and thus can act as an independent QADR. Even though she is under Nicole Casper (Water Resource Manager) who oversees the Air Quality Analyst directly, Shannon is the most qualified person at Swinomish that could complete data review as she does so for the Water Quality Program and is thus aware of best practices.

4.2 - **EPA Regional Office**

Regional Offices are responsible for addressing environmental issues related to the agencies within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs. The major quality assurance charge of EPA's Regional 10 Office is coordinating quality assurance 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 a liaison by making available the technical and quality assurance information developed by EPA Headquarters and the Region to the tribal air agencies within the region, and making EPA Headquarters aware of the unmet quality assurance needs of the state and local agencies

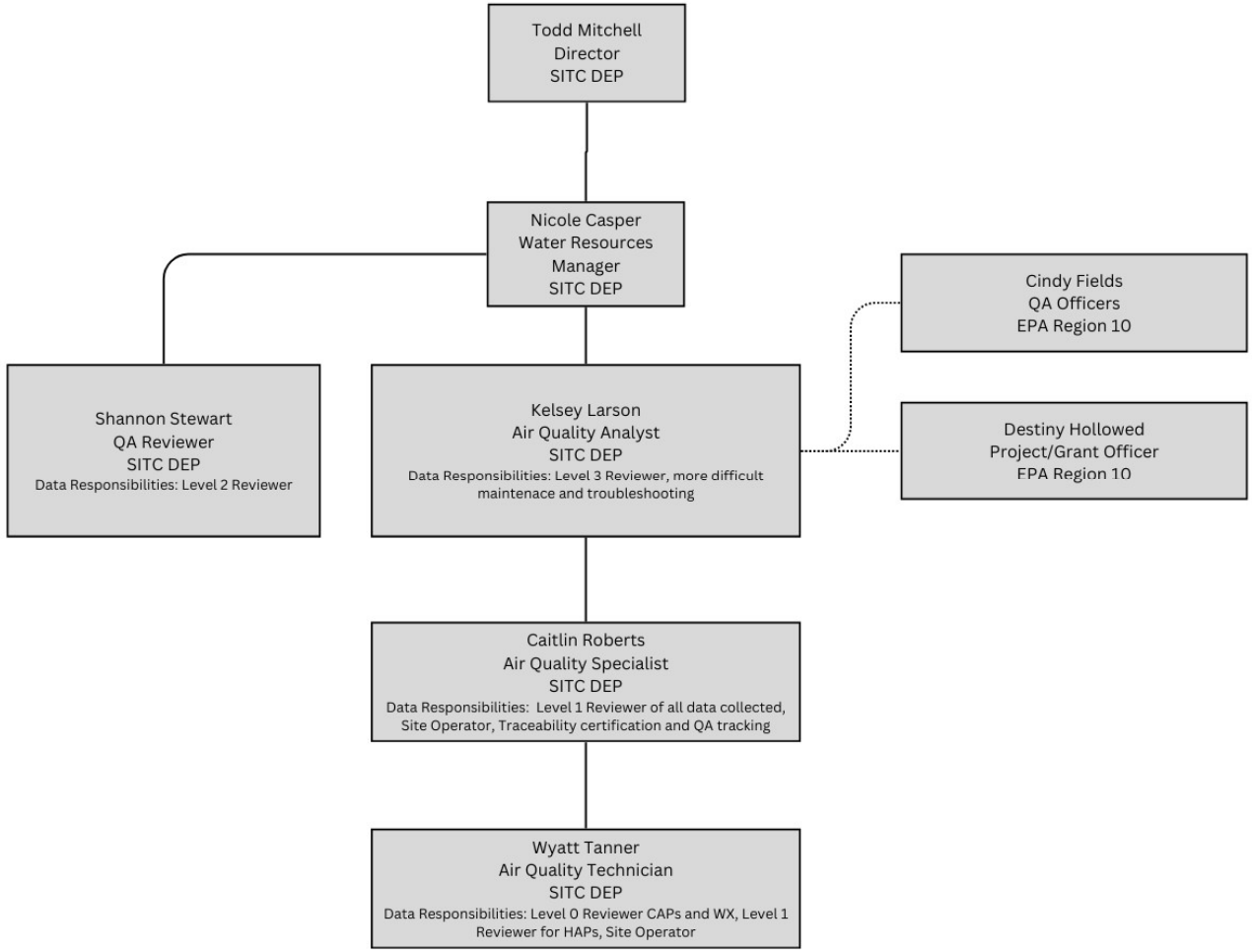
4.2.1 - US EPA R10 Quality Assurance Manager, Cindy Fields

- Reviewing and approving this QAPP

4.2.2 - US EPA Project Manager, Destiny Hollowed

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

Figure 4-1 Project Organization Chart:



Solid lines represent SITC organization hierarchy. Dashed lines indicate communication pathways.

Element 5 - PROBLEM BACKGROUND/DEFINITION (A5)

The populace on the Swinomish Reservation is located within 3-5 miles of two refineries at March's Point. The Shell Puget Sound Refinery (now operated by HollyFrontier) in February of 2015 released a "plume of un-combusted vapors containing hydrogen sulfide, dimethyl sulfide, mercaptans, pyrophoric iron, benzene, and other hazardous substances" from the East flare stack, "resulting in strong odors that reached the Swinomish Reservation, the City of La Conner, and surrounding areas."[1] These chemical-laden fumes from Shell's Puget Sound Refinery that bypassed emissions reduction technology caused at least 12 tribal members to seek medical treatment. In total, 176 members created written accounts of the incident describing health impacts. The NWCAA issued a Notice of Violation in 2016 to Shell for not following shutdown and decontamination procedures during flare cleaning. While action was taken due to the refinery's failure to follow safety procedures, no EPA actions were taken based on the concentrations of air pollutants emitted. As the EPA noted in a letter to the Tribe on 11/4/2020: "none of the individual chemicals released on that day were above the reportable quantity based on Shell's calculations. We have no information to indicate those calculations were incorrect."

In response, our Swinomish Ambient Air Monitoring Program added monitoring of Volatile Organic Compounds (VOCs) – particularly those classified as Hazardous Air Pollutants (HAPs) – using Summa passivated stainless steel canisters to capture air samples and analyzed using the EPA Method TO-15. However, that does not assist us in the midst of an emergency; canisters can only help characterize plumes weeks after. This became painfully apparent when on 9/29/2020 another refinery release event occurred. Luckily, the event did not last as long as the 2015 event; however, emergency management staff wanted to know more information than the Swinomish Ambient Air Monitoring Program could provide.

As was brought up in the subsequent meeting with the EPA upon the imposition of the fines for the 2015 release, the community - unlike the workers at the refinery - do not have basic real time monitors for H_2S and VOCs. Real time monitors that can resolve VOCs are incredibly expensive and staff time intensive, but SO_2 and H_2S monitors are much more feasible. Additionally, air containing SO_2 and H_2S in high concentrations are indicators of refinery air that has bypassed scrubbers that remove very harmful VOCs.

The closest continuous ambient monitors of SO_2 and H_2S, operated by the NWCAA, are located at Bartholomew Road (within 500 m southwest of the HollyFrontier stacks) and near the Anacortes Docks roughly 20 miles away (Figure 5-1). In the release event in September 2020, NWCAA's monitoring staff observed that H_2S and SO_2 were not majorly elevated. We requested the assistance of EPA Region 10 modeler Jerrold McAlpine to better understand this event using the American Meteorological Society/Environmental Protection Agency Regulatory (AERMOD) Model. Dr. McAlpine used wind data from SAQMS1 and SAQMS4 to model emission of one (1) gram/second at three (3) seventy-five (75)-meter high flares over three (3) hours on 9/29/2020. The AERMOD results – shown in Figure 5-1– indicate the Bartholomew Road site was not within the most likely least diluted regions of the plume.

This case study supports what we would expect: when winds are right to pull refinery emissions over the reservation's most populous region, we cannot rely on monitoring off-Reservation (i.e. Bartholomew Rd and

[1] From the Consent Agreement and Final Order of the settlement between the EPA and Shell filed 12/29/2020. Docket No. CAA-10-2021-0003

202nd Ave) to characterize air pollution. We do not currently have instantaneous measurement capabilities for common compounds found in or created by fossil fuel processing Title V sources in the most populous region of the reservation.

The objective of this program is to 1) monitor ambient SO_2 and H_2S concentrations from Refinery emissions, 2) create a real time portal for Emergency Response Staff to make public health decisions based on SO_2 and H_2S concentrations, 3) provide real time data to the public to make personal health decisions, 4) establish the baseline of SO_2 and H_2S concentrations on Reservation, 5) report findings to local, state, and Feder agencies, and 6) determine if SO_2 monitoring for the enforcement of the NAAQS should be restarted.

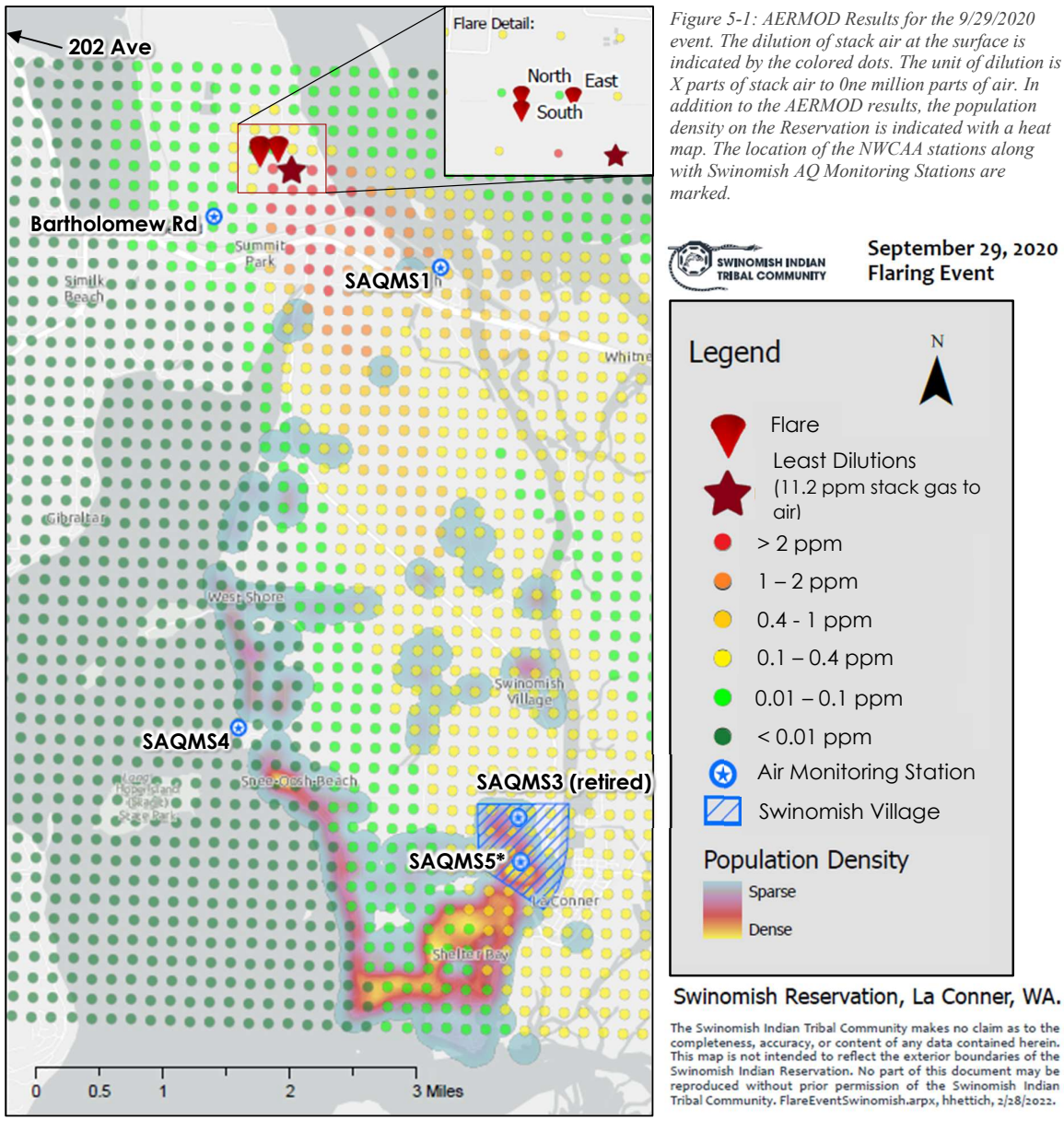


Figure 5-1: AERMOD Results for the 9/29/2020 event. The dilution of stack air at the surface is indicated by the colored dots. The unit of dilution is X parts of stack air to 0ne million parts of air. In addition to the AERMOD results, the population density on the Reservation is indicated with a heat map. The location of the NWCAA stations along with Swinomish AQ Monitoring Stations are marked.

This QAPP describes project methods, refers to EPA-established data quality objectives, and defines data quality assurance and control methods for our monitoring of SO_2 and H_2S at two locations: SAQMS1 (near refinery) and SAQMS5 (not built yet; in the Swinomish Village area). The QAPP was developed to ensure consistent, repeatable results and to improve the reliability and comparability of data collected. We are adopting a Category II QAPP (Appendix C of the QA Handbook, Vol. 2) because the data we gather will be used for real-time monitoring and determining health impacts.

In the following section (A5.1) will outline general sources and emissions of SO_2 and H_2S on or near Reservation. Section A5.2 will indicate the relevant health impacts of SO_2 and H_2S on the people and environment.

5.1 - Sources of SO_2 and H_2S

Sulfur Dioxide and Hydrogen Sulfide are primarily anthropogenically admitted from fossil fuel burning. While there are natural sources of SO_2 and H_2S these are commonly found in high concentrations near volcanic activity. The EPA tracks the emissions of SO_2 and H_2S and compiles the yearly emissions in the National Emissions Inventory (NEI) which is published every three (3) years. In general, SO_2 and H_2S emissions are dominated by facilities.

The 2014, 2017, and 2020 NEI emissions of SO_2 from facilities are shown in Figure 5-1, 5-2, and 5-3, respectively. The 2014 NEI of H_2S seems abnormally low; because of this, the 2017 and 2020 NEI emissions of H_2S are shown in Figure 5-4 and 5-5, respectively. Emissions of SO_2 have been decreasing slightly (which follows the general trend of SO_2 emissions in the United States generally. From the H_2S emissions we can see that the source of H_2S is are mainly the two refineries at March Point or the two refineries in Whatcom County. The only near Reservation source that is not a refinery is the pulp and paper mill near Port Townsend in Jefferson County.

There is one more important source of sulfur compounds: Ocean going vessels. The EPA regulates that the fuel for ocean going ships (large engines) must be less than 1000 ppm in sulfur content. These types of vessels then are moving point sources of sulfur compounds. The shipping tracks near Swinomish are shown in Figure 5-6.

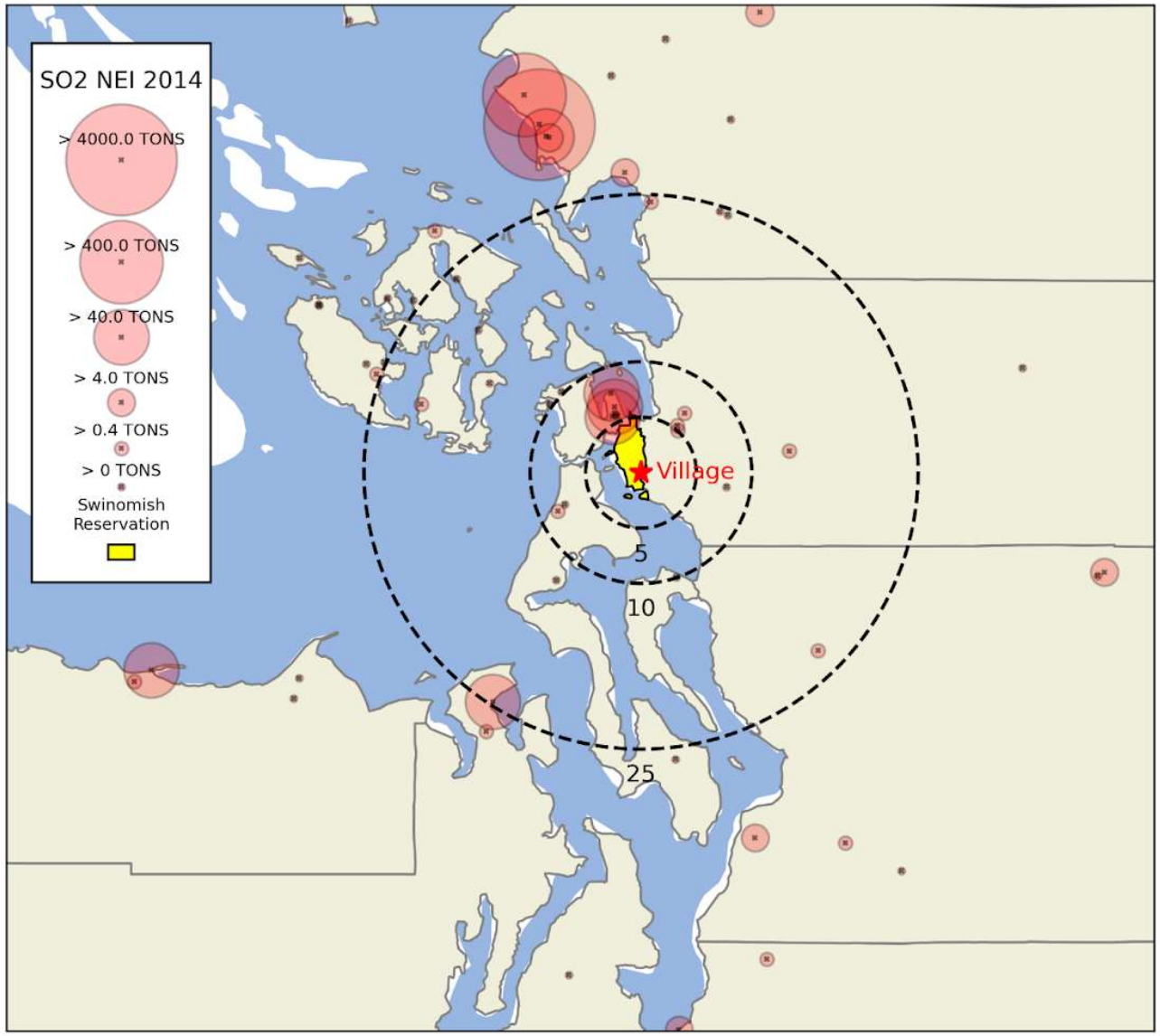


Figure 5-2: SO_2 Emissions from Point Sources in 2014 from the EPA's NEI.

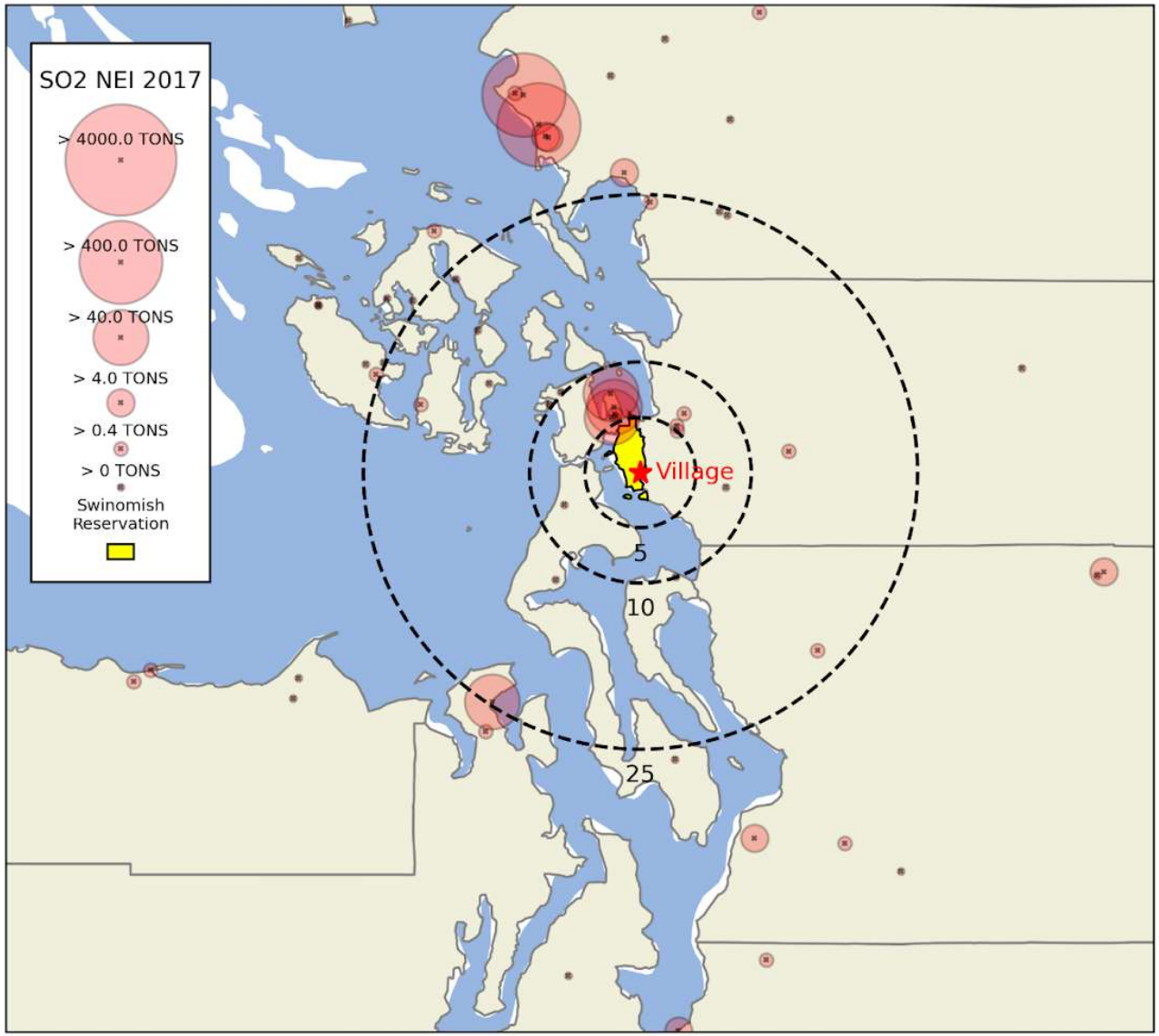


Figure 5-3: SO_2 Emissions from Point Sources in 2017 from the EPA's NEI.

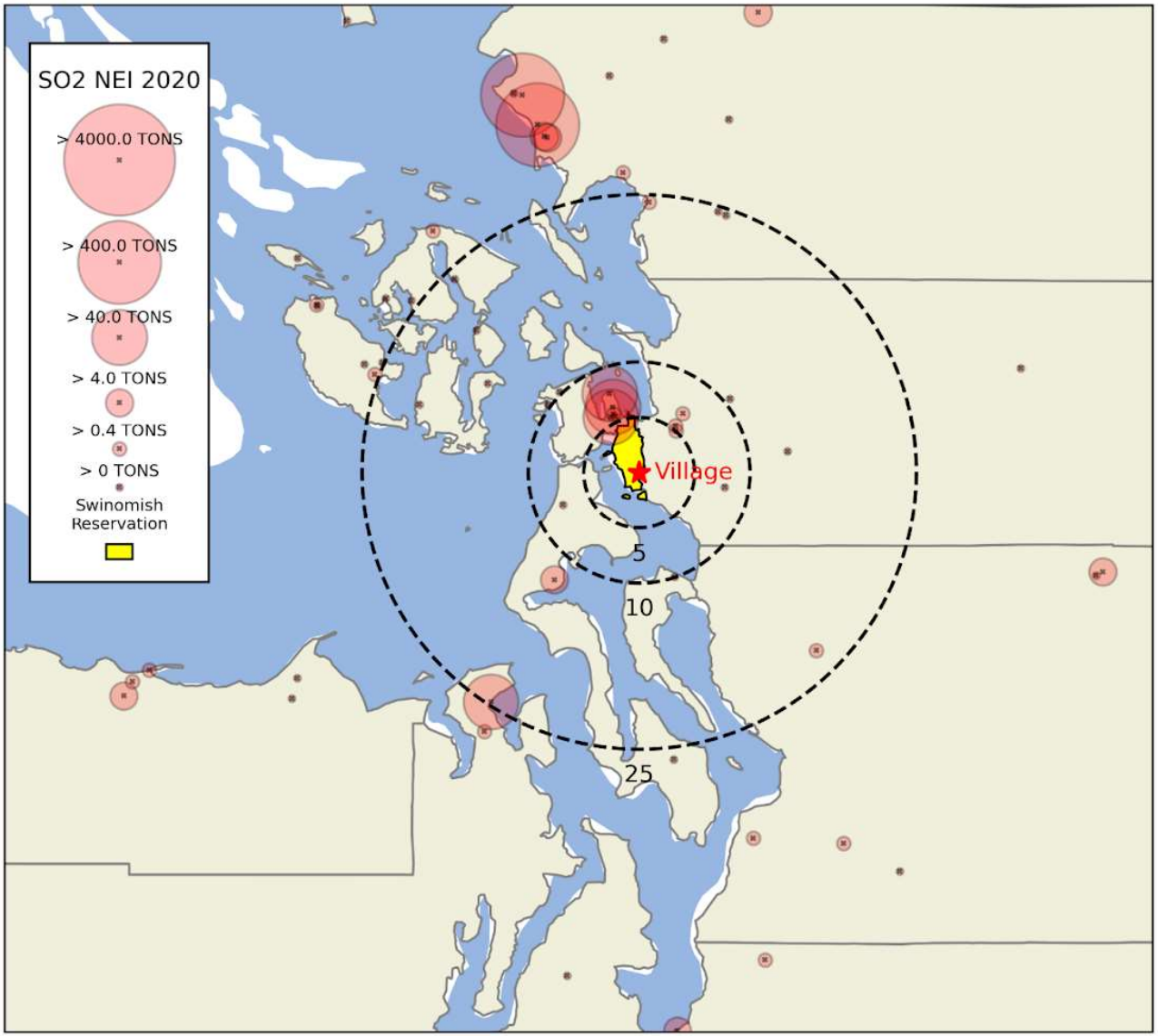


Figure 5-4: SO_2 Emissions from Point Sources in 2020 from the EPA's NEI.

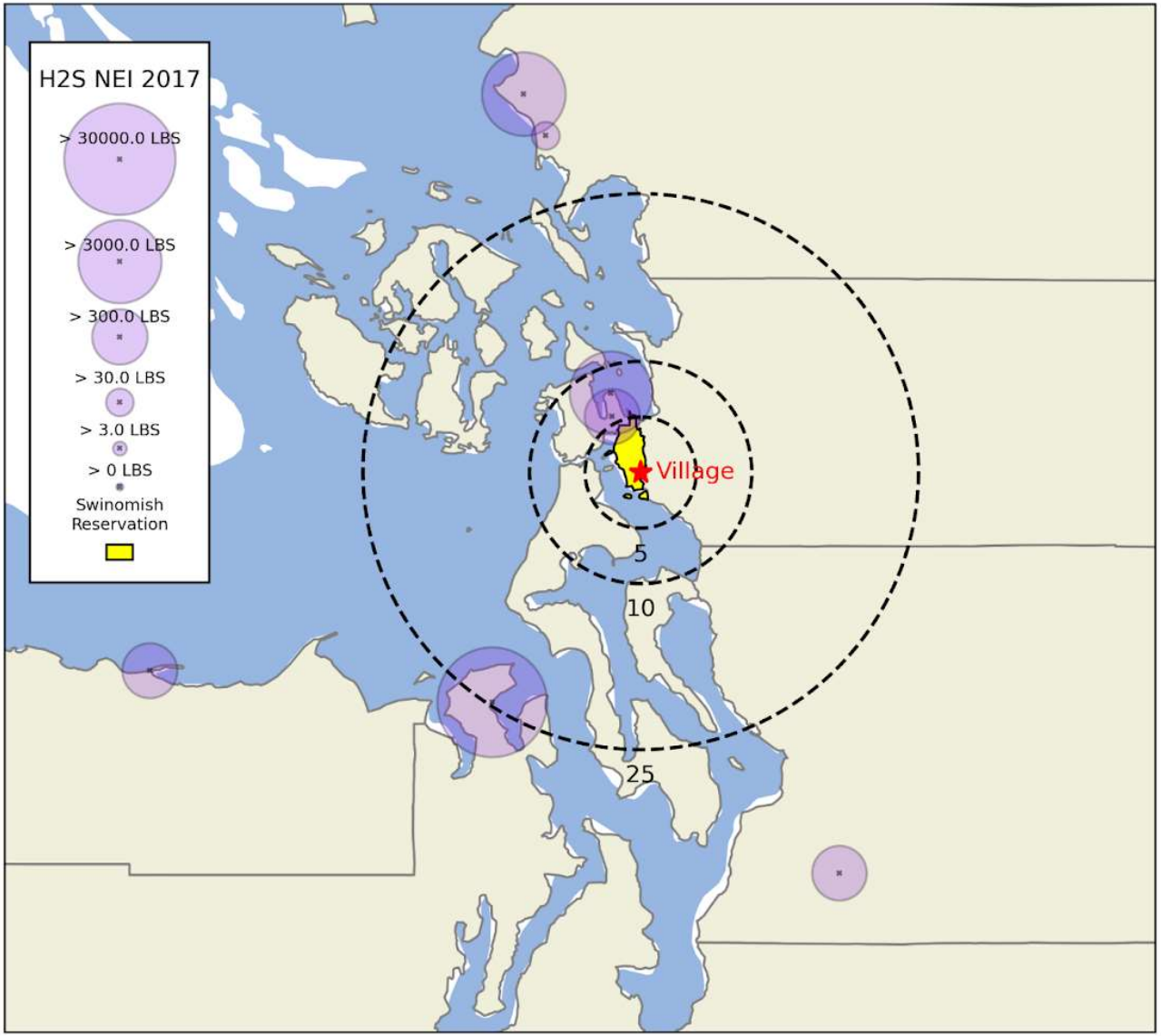


Figure 5-5: H_2S Emissions from Point Sources in 2017 from the EPA's NEI

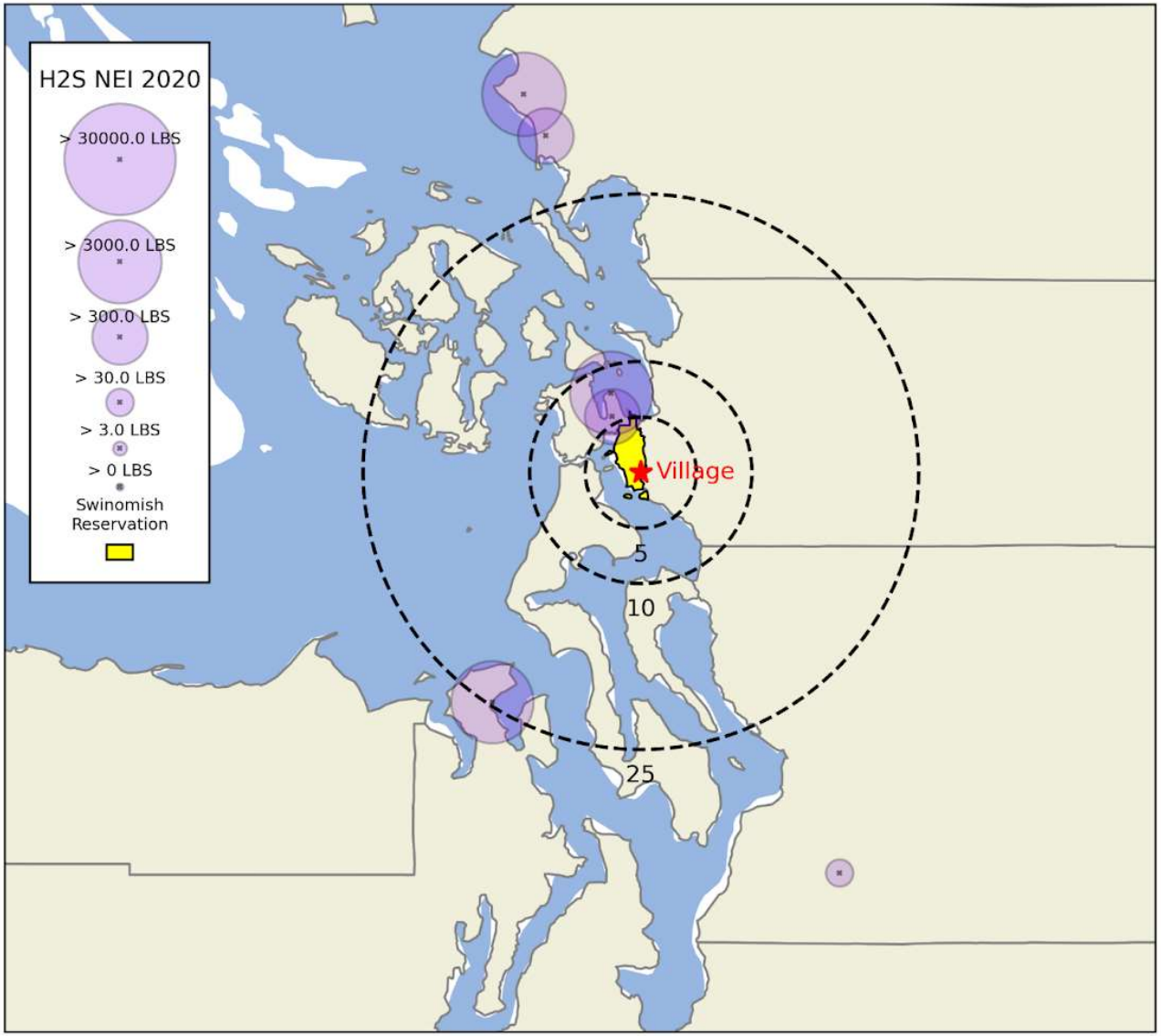
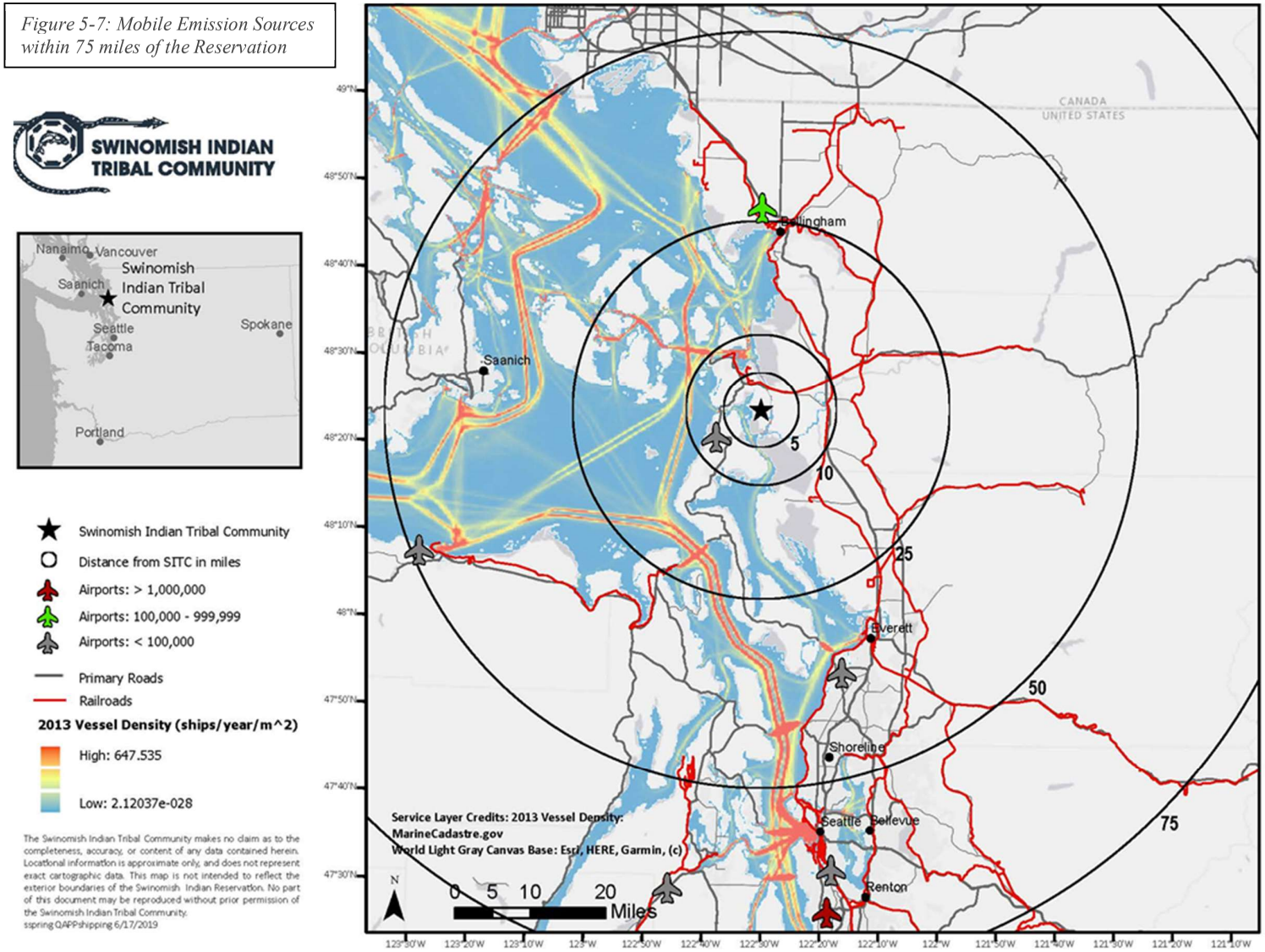


Figure 5-6: H_2S Emissions from Point Sources in 2020 from the EPA's NEI.

Figure 5-7: Mobile Emission Sources within 75 miles of the Reservation



Element 6 - PROJECT DESCRIPTION (A6)

To create a real-time public portal for the general public and an Emergency Response tool for Swinomish Emergency Management Staff, Swinomish will establish two monitoring sites for SO_2 and H_2S. Where applicable and practical, Swinomish will follow guidance pertaining to air quality and meteorological 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);
E. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements Version 2.0 (Final) EPA-454/D-06-001, March 2008;
F. Guidance for on Systematic Planning Using the Data Quality Objective Process (QA/G-4), EPA/240/B-06/001), February 2006

6.1 - **Monitoring Locations**

Swinomish has established one Swinomish Air Quality Monitoring Stations (SAQMS1) near March Point at the Swinomish Casino. A second site is planned to be built in 2024 within the most populous region of the Reservation in the Swinomish Village (SAQMS5). More information on each site can be found in the Swinomish 2024 Site Network Plan. For this specific project, the monitoring stations include the following:

- Environmentally controlled shelters;
- Teledyne Advanced Pollution Instrumentation (TAPI) Model T101 Ultraviolet (UV) Fluorescence H_2S Analyzer in switch mode (mode to monitor SO_2 and H_2S)
- Campbell Scientific Model CR1000 data logger;
- TAPI Model T700 Dynamic Dilution Calibrator OR 146iQ Thermo Fisher Multi Gas Calibrator
- TAPI Model T701 Zero Air System OR 111iQ Thermo Fisher Zero Air Generator
- Teflon® inlet system, designed to ensure less than 20 seconds residence time, and to mirror criteria for SO_2 monitoring probe siting as established in Section 9 of 40 CFR Part 50, Appendix E;
- Ethernet connection OR Wireless router with cellular modem.

The TAPI T101 H_2S Analyzers have a lower detectable limit of 0.4 parts per billion (ppb) for H_2S and SO_2 and will be operated on the 1000 ppb range for both species. The CR1000 will be configured to store 5-minute averages for H_2S and SO_2 and diagnostic parameters (e.g., lamp intensity, sample flow, etc.) through a flagging system developed by Campbell Scientific programmers. The TAPI T101 will be configured to save data hourly as a back-up.

Multipoint calibrations and daily one-point QC precision checks are performed using a TAPI T700 dynamic dilution calibrator or a 146iQ Thermo Fisher 146iQ (depending on the station) and 50 parts per

million (ppm) EPA Protocol 1 gas cylinder. This system combination allows calibration gasses to be accurately generated in the range of 10 to 1000 ppb. A single-point daily one-point check is performed at a level of 70 ppbv. Once per week a 3-point calibration verification (zero, precision, and span) is performed at zero, 70 and 800 ppb for both H_2S and SO_2.

The data collection system for the H_2S and SO_2 analyzers will utilize a Campbell Scientific Model CR1000 data logger with NL121 attachment to allow Ethernet Connection. The datalogger will acquire, average, and store data digitally. The data acquisition system has the capability to record the sensor's output, scale the raw value into an engineering unit, and transmit the data to LoggerNet or Campbell Cloud database systems.

6.2 - **Monitoring Schedule Overview**

Timeline for establishing monitoring:

Table 6-1: Schedule for Monitoring Program Implementation

	2023			2024											2025											
Task	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
QAPP Development and Finalization			1							2																	
Instrument Purchasing				3		4																					
SAQMS1 Monitoring SO2/H2S						5				6					7												>
New DAS Install and Implementation											8		9								10						
SAQMS5 Construction										11											12						
SAQMS5 Monitoring SO2/H2S															13			14									>

> = Milestone

The milestones numbered in Table 6-1are:

1. QAPP Draft submitted to EPA and Contractor for Review
2. QAPP Finalized and Approvals Obtained
3. Instruments Purchased (Submit POs to Teledyne)
4. Instruments Arrive at Swinomish
5. Instruments Installed at SAQMS1
6. Complete Testing of Instrumentation (could be sooner) at SAQMS1; QC Checks being completed
7. SOPs complete
8. Install of Agilaire Data Acquisition System (DAS); develop SOPs for Data QA/QC
9. First quarter of using purely Agilaire as the DAS at SAQMS1
10. Installation deadline for one of the Agilaire DAS to be installed at SAQMS5
11. Construction begins on SAQMS5 (Uncertain due to funding)
12. Construction ends on SAQMS5 (Uncertain due to funding)

13. Instruments installed at SAQMS5

14. Complete Testing of Instrumentation (could be sooner) at SAQMS5; QC Checks being completed

The first QC measurements on the aforementioned instruments will be made in accordance with the requirements and limits described further in element 14. The results of QC checks will be entered into our database, which automatically calculates whether QC results are within limits (see element 14; these limits are from the QA Handbook vol. 2, Appendix D) and identifies out-of-limit results. All valid data must be bracketed by passing QC checks (before and after, in accordance with the schedule in element 14). The data will be retrieved from the analyzer at least every two weeks and all data will be reviewed as it is imported into our tribal database. Once established, the continuous monitoring of SO2 and H2S will be ongoing, with no planned end date.

At least every quarter, the data will undergo the final data validation process in accordance with our SOP for Final Data Validation (attached, and see element 14). Assessments, including external audits, will be conducted as frequently as necessary (see validation tables in element 14) to meet the project objectives. These are fully described in element 20 (C1). Equipment maintenance and its schedule is described in element 15 (B6) and calibration and its schedule in element 16 (B7).

Hourly values as well as the supporting QC results will be uploaded to AQS quarterly. 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.

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

As described in the EPA guidance for QAPPs (see QA/G-5 in References), the Data Quality Objectives (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 Measurement Quality Objectives (QC limits) for the Swinomish Ambient Air Quality Program's SO_2 and H_2S Monitoring Project for the purpose of Emergency Response and Community Awareness. Where possible, we will use MQOs that correspond to the requirements for NAAQS enforcement to ensure good data quality.

7.1 - **DQO Evaluation**

As we are using some of the MQOs established by EPA, our office implemented the DQO Process as strongly advised in the QA Handbook. This process is described below:

7.1.1 - Stating the problem

The populace on the Swinomish Reservation are located within 3 miles of two refineries at March Point. As described in Element 5, recurring releasing of unknown mixtures of hazardous and/or irritating gasses have resulted in hospitalizations, shelter-in-place orders, and community members feeling unsafe in their own homes.

The closest continuous ambient monitors of SO_2 and H_2S are located at Bartholomew road (within 500 m southwest of the stacks of Holly Frontier) and near the Anacortes Docks roughly 20 miles away. When prevailing winds would result in plumes being carried over the Reservation, these sites cannot provide information about the content of the plume. Swinomish does not currently have instantaneous measurement capabilities of common compounds found in or created by fossil fuel processing (SO_2 and H_2S) Title V sources in the most populous region of the Reservation.

Because of the recurrence of these events, the community seeks to:

1. Monitor levels of air pollutants that are likely to come from the refinery (SO_2 and H_2S)
2. Determine a baseline of SO_2 and H_2S to be able to identify abnormal air quality events. (3 year)
3. Provide real-time quality assured SO_2 and H_2S concentrations and guidance to Community member and Emergency Response Personnel during air quality emergencies (Refinery Releases)
4. Identify if monitored SO_2concentrations exceed the NAAQS SO_2 primary and secondary levels to determine if Swinomish should restart monitoring SO_2 for enforcement of the NAAQS.
5. Compare H_2S to 24-hour ASILs and Acute Minimum Risk Levels (MRLs) from the CDC (if applicable) to determine if ASILs or MRLs are exceeded. Any exceedances will be reported to

Swinomish DEP management and possibly SITC Senate Committees or the Senate for determination of next steps. Next Steps could include reporting ASIL or MRL exceedances to the NWCAA.

6. Calculate the total Hazard Quotient from H_2S monitored will be calculated using EPA supplied toxicological indexes every year using the annual average. These will be reported to DEP management.

7.1.2 - 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 spikes, we will compare SO_2 and H_2S concentrations to nearby NWCAA monitors.
- For determination of excess Cancer Risk, Hazard Quotient or exceedance of either ASILs or MRLs, all relevant information is shown in Table 7-1.
- To determine sources for abnormal or elevated air pollutant levels, 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.
- In cases of an accidental releases from nearby sources (like 9/29/2020 event), SITC will reach out to the EPA's Region 10 Modelling office to run AERMOD using SITC's Weather data.

7.1.3 - Define the boundaries of the project

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

- Acute:
  - Realtime concentrations of SO_2 and H_2S above 75 and 70 ppbv, respectively OR notification of a Refinery Release Events to indicate that the plume of unknown gasses originating from the Refinery is present.
    - 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 or evacuation orders issued by Emergency Management Staff.
- Chronic:
  - The temporal boundary for SO_2 requires hourly data of SO_2 for three (3) 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.
  - The temporal boundary for H2S requires hourly data for a full day. The 24 hour averaged values will be assessed on an ongoing basis and compared with the CDC's acute MRL of 70 ppbv.

7.1.4 - Deciding on a decision rule

Consistent with our objective to provide information to the community, we will:

- Have a DAS system running Level 0 QAQC on all data posted in real-time. When QA/QC issues are identified, the instrument will be removed from realtime posting.
- Evaluate daily averages as we gather the data, and issue public health advisories based on the AQI if results indicate that any population is at risk.

- If we see large deviations from SO_2 and H_2S concentration background, we will use a mixture of meteorological observations and modeling to determine the source.
    - Until background is established, the background is assumed to be similar to the national average concentration of SO_2 of 5-10 ppbv.
- In times of Emergency issued by Title V sources (Refinery known/unknown gaseous release) OR when SO_2 and H_2S exceed the hourly concentrations of 75 ppbv or 70 ppbv, respectively, SITC AQ Staff will provide technical assistance to Emergency Response staff to determine how to best communicate dangers to community members.
    - Include (but not limited to) real-time measurements, interpretation of hourly trends, forecasting using NRMC WRF output and HYSPLIT, and weather trends
- Evaluate 24-hour samples as we gather the data, and report exceedances to management to determine further steps which may include community reporting. Regardless of individual samples, annual reports in the form of Qyuuqs articles (local SITC newspaper) will be used to summarize findings for the community.

7.1.5 - 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 H_2S data indicate a monitor exceeded the CDC's Acute mRL when in fact, due to random deviations in the data, the monitor did not exceed it.
- False negative error when the H_2S data indicate the monitor did not exceed the CDC's Acute mRL when in fact, due to random deviations in the data, the monitor did exceed it.

The Acceptable Precision and Bias for automated SO_2 and H_2S monitoring is listed below in Table 7-1.

Table 7-1: Acceptable Precision as Measured by Coefficient of Variation (CV) and Bias for Criteria Air Pollutant and Precursor

Pollutant	Acceptable Precision	Acceptable Bias	Reference
SO_2	upper 90 percent confidence limit for the CV of ≤15 percent SITC Goal: upper 90 percent confidence limit for the CV of ≤10 percent	Upper 95 percent confidence limit for the absolute bias of ≤15 percent SITC Goal: Upper 95 percent confidence limit for the absolute bias of ≤10 percent	Goal: 40 CFR Part 58, Appendix A, Section 2.3.1.5*
H_2S	upper 90 percent confidence limit for the CV of ≤15 percent SITC Goal: upper 90 percent confidence limit for the CV of ≤10 percent	Upper 95 percent confidence limit for the absolute bias of ≤10 percent SITC Goal: Upper 95 percent confidence limit for the absolute bias of ≤10 percent	Based on SO2

* Even though we are referencing the CFR for NAAQS Enforcement, due to the monitors used even if these P&B are met the data collected cannot enforce the NAAQS; For data quality purposes, are goals are to meet the same P&B as NAAQS monitors.

7.1.6 - Optimizing the design

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

- The presence of refinery air during an unknown hazardous air pollutant release event.
- 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 SO_2 and H_2S, respectively.

Table 7-2: Primary and Secondary National Ambient Air Quality Standards of SO2

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Sulfur Dioxide (SO_2)	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Table 7-3: Classification of H_2S as HAP or TAP, ASILs from WAC, URE and/or RfC from EPA's IRIS, mRLs from the CDC, and OSHA standards from CFR 1910

			WAC 173-460-150		Life Time (70 years)		Chronic (365+ days)		Intermediate (15-364 days)		Acute (< 14 days)		OSHA CFR 1910	
Name [CAS]	**HAP**	**TAP**	ASIL (ug/m3)	Averaging Time	**URE 1/(ug/m3)**	**RfC (mg/m3)**	mRL (ppm)	Factor	mRL (ppb)	Factor	mRL (ppb)	Factor	Ceiling Limit	Unit
Hydrogen Sulfide [7783-6-4]	Y	Y	2.00E+00	24-hr	Inadequate Info	2.10E-03	-	-	20	30	70	27	20000	ppb

7.2 - **Measurement Quality Objectives**

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. Measurement Quality Objectives (MQOs) are designed to evaluate and control various phases (sampling, preparation, 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:

- **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 1-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 US 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 (H_2S), 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 SO_2). 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 US EPA's data assessment statistical calculator (DASC) 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 air quality 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 in 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 detection limit of the H_2S analyzers is 0.4 ppb, values recorded below the analyzer's detection limit are reported as ½ the detection limit (0.2 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 and 7-5 for SO_2 and H_2S, respectively. In theory, if these MQOs are met, measurement uncertainty should be controlled to the levels required by the DQO.

Table 7-4: Measurement Quality Objective Parameter – Sulfur Dioxide (SO2) (Ultraviolet Fluorescence)

1) Requirement	2) Frequency	3) Acceptance Criteria	Information/Action
CRITICAL CRITERIA - SO2			
One Point QC Check	Every 14 days is required (SITC goal is daily automated checks)	<=±15.1% (percent difference between analyzer and known concentration) OR ± 3.75 ppb difference, whichever greater (SITC goal is <=±10.1% OR ± 1.5 ppb difference, whichever greater)	1 and 2) 150% of SITC Goal which originate from 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/precision/span check	Every 14 days is required (SITC goal is daily automated checks)	zero drift by <=±4.6 ppb (24 hrs) OR <=±7.6 ppb (>24hr-14 days) span drift <=±15.1 % (SITC goal is zero drift by <=±3.1 ppb (24 hrs) OR <=±5.1 ppb (>24hr-14 days) span drift <=±10.1 %)	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
Shelter Temperature Range	Daily (hourly values)	20 to 30 ºC (hourly average)	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
OPERATIONAL CRITERIA - SO_2			
Shelter Temperature Control	Daily (hourly values)	<= ±2.1 ºC standard deviation over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	Every 182 days and 2/ 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 1/calendar year within period of monitor operation	Percent difference for audit concentration levels 3 through 10 must be <=±15% audit levels 1&2: less than ±2.25 ppb difference or ±15.1%.	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) AMTIC guidance dated 2/17/2011
Verification / Calibration	Upon receipt/adjustment/repair/ installation/moving; When 1-point-QC check is > 12.0 percent difference; 1/365 days and 1/calendar year	Span/Span2 within ± 7.5 percent of expected 1-point-QC check ≤ 12.0 percent difference Zero within ± 1.5 ppb of expected Slope of best fit line = 1 ±0.075 and each point within 3 percent of best fit line or ± 2.25 ppb, whichever is greater	1) 40 CFR Part 50 App A-1 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
Gaseous Standards	Replace or recertify Cylinder upon expiration date (every 3 years)	NIST Traceable (e.g., EPA Protocol Gas)	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.1 2) The 2012 EPA Traceability Protocol EPA-

			600/R-12/531 Procedure G1 3) 40 CFR Part 50 App A-1 Sec. 4.1.6.1
Zero Air/Zero Air Check	Chemicals changed 1/365 days and 1/year	Concentrations below lowest detectable level (LDL) (<1.5 ppbv)	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.2 2 and 3) Recommendation
Flow Rate Verification of Gas Dilution Systems (Single-Point Flow Rate Check)	1/month	<±2.1% of Flow Rate Transfer Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513)
Gas Dilution Systems: Multipoint Flow Rate Calibration	1/calendar year	<±2.1% of NIST-traceable Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513) External Check by ThermoFisher Scientific 146iQ OR Teledyne T700U
Flow Rate Transfer Standard (used for Verification)	1/calendar year	<±2.1% of NIST-traceable Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513) External Check by MesaLabs
Detection: Noise	Verified by manufacturer at purchase	≤ 0.001 ppm (standard range)	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Detection: Lower Detectable Level	Verified by manufacturer at purchase	≤ 0.002 ppm (standard range)	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA - SO_2			
Standard Reporting Units	All data	ppb (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	1 places after decimal with digits to right truncated	1, 2 and 3) 40 CFR Part 50 App T Sec. 4.2 (a)
Completeness	1-hour Standard	Hour – ≥ 75 percent of hour Day- ≥ 75 percent of hourly concentrations Quarter- ≥ 75 percent complete days Years-4 complete quarters 5-minute values - ≥ 75 percent of minutes 5-minute maximum value reported only for valid hours	1) 40 CFR Part 50 App T Sec. 3.2(b) 2) 40 CFR Part 50 App T Sec. 3.2(a) 3) 40 CFR Part 50 App T Sec. 3.2(b) More details in 40 CFR Part 50 App T

Sample Residence Time Verification	At installation, 1/365 days and 1/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	1/365 days and 1/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
Precision (using 1-point QC checks)	Calculated annually and as appropriate for design value estimates	90% CL CV < 15.1% SITC goal is 90% CL CV < 10.1%	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 1-point QC checks)	Calculated annually and as appropriate for design value estimates	95% CL < ± 15.1% SITC goal is 95% CL < ± 10.1%	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

Table 7-5: Measurement Quality Objective Parameter – Hydrogen Sulfide (H2S) (Ultraviolet Fluorescence)

1) Requirement	2) Frequency	3) Acceptance Criteria	Information/Action
CRITICAL CRITERIA - H_2S			
One Point QC Check	Every 14 days is required (SITC goal is daily automated checks)	<=±15.1% (percent difference between analyzer and known concentration) OR ± 3.75 ppb difference, whichever greater (SITC goal is <=±10.1% OR ± 1.5 ppb difference, whichever greater)	1 and 2) 150% of SITC Goal which are based on SO2 requirements in 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/precision/span check	Every 14 days is required (SITC goal is daily automated checks)	zero drift by <=±4.6 ppb (24 hrs) OR <=±7.6 ppb (>24hr-14 days) span drift <=±15.1 % (SITC goal is zero drift by <=±3.1 ppb (24 hrs) OR <=±5.1 ppb (>24hr-14 days) span drift <=±10.1 %)	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
Thermal Catalytic Converter Efficiency	Quarterly is required (SITC's Goal is every 14 days)	>=93% (SITC goal: >= 96%)	150% of similar converter requirements of NO2 to NO
OPERATIONAL CRITERIA - H_2S			
Shelter Temperature Control	Daily (hourly values)	<= ±2.1 ºC standard deviation over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	Every 182 days and 2/ 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 1/calendar year within period of monitor operation	Percent difference for audit concentration levels 3 through 10 must be <=±15% audit levels 1&2: less than ±2.25 ppb difference or ±15.1%.	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) AMTIC guidance dated 2/17/2011
Verification/ Calibration	Upon receipt/adjustment/repair/ installation/moving; When 1-point-QC check is > 12.0 percent difference; 1/365 days and 1/calendar year	Span/Span2 within ± 7.5 percent of expected 1-point-QC check ≤ 12.0 percent difference Zero within ± 1.5 ppb of expected Slope of best fit line = 1 ±0.075 and each point within 3 percent of	1) 40 CFR Part 50 App A-1 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation

		best fit line or ± 2.25 ppb, whichever is greater	
Gaseous Standards	Replace or recertify Cylinder upon expiration date (every 3 years)	NIST Traceable (e.g., EPA Protocol Gas)	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.1 2) The 2012 EPA Traceability Protocol EPA-600/R-12/531 Procedure G1 3) 40 CFR Part 50 App A-1 Sec. 4.1.6.1
Zero Air/Zero Air Check	Chemicals changed 1/365 days and 1/year	Concentrations below lowest detectable level (LDL) (<1.5 ppbv)	1) 40 CFR Part 50 App A-1 Sec. 4.1.6.2 2 and 3) Recommendation
Flow Rate Verification of Gas Dilution Systems (Single-Point Flow Rate Check)	1/month	<±2.1% of Flow Rate Transfer Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513)
Gas Dilution Systems: Multipoint Flow Rate Calibration	1/calendar year	<±2.1% of NIST-traceable Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513) External Check by ThermoFisher Scientific 146iQ OR Teledyne T700U
Flow Rate Transfer Standard (used for Verification)	1/calendar year	<±2.1% of NIST-traceable Standard	EPA Traceability Protocol for Gaseous Calibration Standards (EPA 600/R-12/513) External Check by MesaLabs
Detection: Noise	Verified by manufacturer at purchase	≤ 0.001 ppm (standard range)	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Detection: Lower Detectable Level	Verified by manufacturer at purchase	≤ 0.002 ppm (standard range)	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA - H_2S			
Standard Reporting Units	All data	ppb (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	1 places after decimal with digits to right truncated	1, 2 and 3) 40 CFR Part 50 App T Sec. 4.2 (a)
Completeness	1-hour Standard	Hour – ≥ 75 percent of hour Day- ≥ 75 percent of hourly concentrations Quarter- ≥ 75 percent complete days Years-4 complete quarters 5-minute values - ≥ 75 percent of minutes	1) 40 CFR Part 50 App T Sec. 3.2(b) 2) 40 CFR Part 50 App T Sec. 3.2(a) 3) 40 CFR Part 50 App T Sec. 3.2(b) More details in 40 CFR Part 50 App T

		5-minute maximum value reported only for valid hours	
Sample Residence Time Verification	At installation, 1/365 days and 1/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	1/365 days and 1/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
Precision (using 1-point QC checks)	Calculated annually and as appropriate for design value estimates	90% CL CV < 15.1% SITC goal is 90% CL CV < 10.1%	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 1-point QC checks)	Calculated annually and as appropriate for design value estimates	95% CL < ± 15.1% SITC goal is 95% CL < ± 10.1%	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 8 - SPECIAL TRAINING/CERTIFICATION (A8)

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, AQSp, AQT, and QADR) to read and understand this QAPP, referenced SOPs, and other material as directed. A record of completion of SOP review and completed demonstrations using checklists or collecting samples is recorded in the Training Log worksheet (Element 27).

The QADR will spend at least 32 documented hours reviewing this QAPP, especially section 14 with the data validation tables, and sections 20-24, all relevant SOPs, including the database SOPs, and relevant manufacturer and EPA websites.

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

- Field oversight personnel (AQSp) have a minimum of 1 year of experience operating air quality and meteorological monitoring instrumentation. These individuals are required to adhere to this QAPP and the project SOPs and conduct field activities. Training activities will be recorded by the employee's supervisor.
- Field Technicians (AQT) will have at least 2 months of training with Field oversight personnel before allowing smaller data collection tasks and maintenance (i.e. checking filters, replacing filters, looking at sample lines, etc) to be conducted 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 Air Quality Level 3 reviewer (AQA).
- Data analysis and interpretation, as required, will be performed by Analysts or SPecialists with greater than 5 years of experience.

There are no professional certifications required for this monitoring program. 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, monitoring literature, and EPA regulations. Records on personnel qualifications and training are maintained in personnel files and are accessible for review during audit activities. Adequate education and training are integral to any monitoring program that strives for reliable and comparable data.

DEP also monitors the availability of training courses offered by EPA's Air Pollution Training Institute and Region 10, ITEP, and private firms. Such institutions conduct professional services and ensure certification of their courses offered. When circumstances warrant, staff members may be enrolled in one or more training courses offered by these institutions. Whenever a mentor, experienced staff, partnering tribe or state is available, staff is expected to work with them until such time that they can perform the activity independently.

Element 9 - DOCUMENTS AND RECORDS (A9)

The documentation requirements outlined below will ensure that the location of the records are known, and that the data and supporting information are accessible for the audits. Files are organized in a way that allows each data value to be tracked from the original "raw" measurement result through review, validation, analysis, and reporting.

9.1 - **Document and Record Locations**

SITC primarily keeps electronic files; any paper files generated are scanned to create electronic files for both security and back-up purposes. Electronic files are located in a couple of places:

- Swinomish Network (\\SITC2\) – The Swinomish Network is managed by the Swinomish IT department. The SITC2 is backed up daily on multiple servers. Access to the server requires administrator-level (e.g. DDEP) requests for access. Most, if not all, DEP files are kept under \\SITC2\Planning\USER\WATER\.
- LabArchives – Cloud-based eLogbook application. Subscription-based service with ability to back up on Swinomish Network. Access through mobile application or website. Read-only access for the external auditor would need to be set up by AQSp. See Element 26 for LabArchives SOP.
- Datalogger - Dataloggers collect data records at a specified interval of time; accessed remotely form SITC network connection or at the station.
- Instruments - the T101 also includes data records at specified interval; accessed at station.
- Staff Laptops - Temporary storage location (C:\Campbellsci\LoggerNet\Data) of data and metadata records until transferred to N:

The SITC Network contains the bulk of electronic files or copies of those located in Microix or LabArchives under the subsection 6_AIR_QUALITY. The general location of electronic files are detailed in Table 9-1 on the next page.

Table 9-1: Project Documents and Records

Project Documents and Records			
Categories	**Record/Document Types**	**Location**	**Retention Time**
Site Information	Site Management Plan	\\SITC\	At least 5 years; updated yearly (forever)
	eLogbook records of Site changes	LabArchives \\SITC\	At least 5 years; updated for each activity; downloaded to server yearly (forever)
	EPA Waivers	\\SITC\	At least 5 years; (forever)
Environmental Data Operations	eLogbook records of Data Operations	LabArchives \\SITC\	At least 5 years; updated for each activity; downloaded to server yearly (forever)
	QAPP	\\SITC\	At least 5 years; updated every 5 years
	SOPs	\\SITC\	At least 5 years; updated when changes occur
Raw Data	eLogbook records of Data (usually QAQC data)	LabArchives \\SITC\	At least 5 years; updated for each activity; downloaded to server yearly (forever)
	Raw Data Files	Datalogger Instrument Staff Computers \\SITC\	Kept on Datalogger until filled OR program changed; Kept on instrument until filled; Kept on Staff Computers to transfer to \\SITC: Data kept on \\SITC\ forever.
Data Reporting	Internal Reports on Data Collection status; quarterly and annually	\\SITC\	At least 5 years; (forever)
	External Reports to EPA; quarterly and annually	\\SITC\ Emailed to EPA	At least 5 years; (forever)

Data Management	Data Management Plan	\\SITC\	At least 5 years; updated yearly (forever)
	SOPs	\\SITC\	At least 5 years; updated when changes occur
Quality Assurance	Traceability to NIST standards	\\SITC\	At least 5 years; updated yearly
	eLogbook records of QA/QC procedures and results	LabArchives \\SITC\	At least 5 years; updated for each activity; downloaded to server yearly (forever)
	QA/QC results (Templates)	\\SITC\	At least 5 years; updated yearly
	QA/QC'd Data	\\SITC\ AQS (eventually; need 1 year)	Forever; updated quarterly

9.2 - **Document and Record Upkeep**

Project Planning refers to all the planning activities that we perform as we write and revise our QAPP. The AQT is responsible for, with support from the AQSp, spending approximately 6 hours each week solely on filing, scanning, and organizing records so that they are up-to-date.

Generally, Data files/records and supporting documentation (ex: data logger programs) are kept for as long as possible in electronic form. Supplemental documents (procurement docs) are kept for at least 5 years. Swinomish DEP has a “File Management Protocol” for DEP files that describes the archiving process of physical files in detail.

Additionally, SAAQP keeps an annually updated “Data Management Plan for the Ambient Air Monitoring Program" which includes more details on allowable file types, file/data use, 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 NAAQS in the EPA QA Handbook Ambient Air Monitoring Volume II: Ambient Air Quality Monitoring Program.

DATA GENERATION AND ACQUISITION (Group B)

Element 10 - SAMPLING DESIGN (B1)

This section describes the rationale for the locations of the measurements, the frequency of sampling, the types of monitors used, and the location and frequency of evaluating whether the site still meets the requirements.

The Swinomish Site Management Plan includes detailed information on the locations, instrumentation placement, and waivers/approvals. The Site Management Plan also discusses in detail the reason for site selection and the processes included in the site selection process for each Station in the SAAMP.

While Swinomish is not required to update its Site Management Plan as States are, past experience has highlighted the need for at least annual updates to previous Sampling Site descriptions in previous Swinomish QAPP. Utilizing a Site Management Plan and requiring annual updates to the EPA will hopefully avoid this issue in the future.

10.1 - **Sampling Locations**

For this specific project, we selected one of the two existing site – SAQMS1 (See Figure 10-1) – due to its location being the closest we can get to the two March Point refineries. Thus, we can monitor the wind conditions on the north end of the Reservation during a release and the near source concentrations that are travelling towards the more populous regions of the Reservation (southern and western coasts as shown also in Figure 10-1).

We identified a location within the Swinomish Village – the most densely populated part of the Swinomish Reservation of tribal members - to specifically know the real-time concentrations and evolution of atmospheric stability and wind direction. This project is specifically about the real-time concentrations. The location of this monitoring station is shown on Figure 10-1 as SAQMS5.

10.2 - **Sample Scheduling**

The Schedule of Quality Assurance Practices for Criteria Air Pollutants and Precursors Data Collection are described further in Table 10-1 (next page)

Figure 10-1: Location of SAQMS and Residential addresses on Swinomish Reservation.

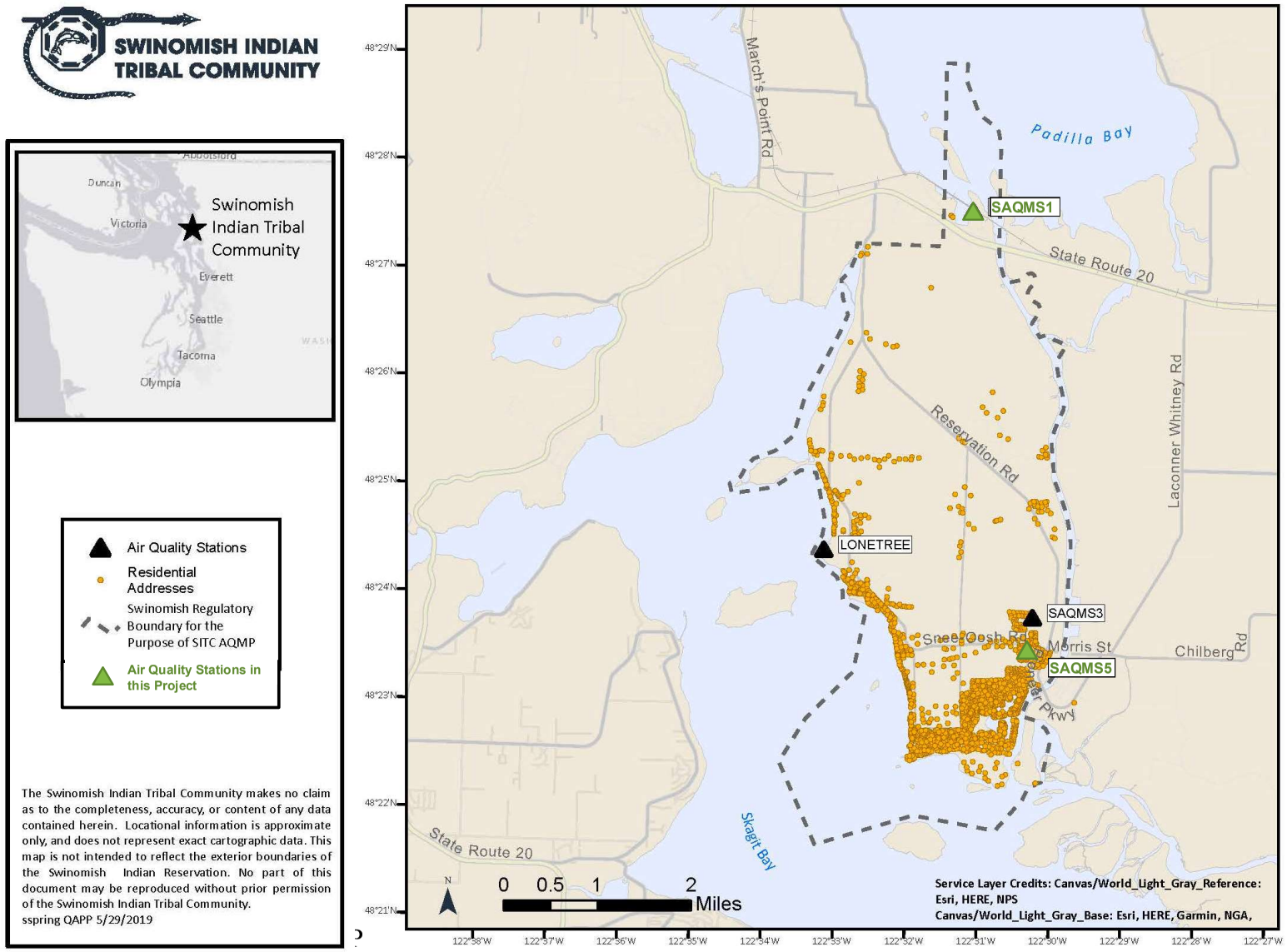


Table 10-1: Quality Assurance Schedule for SO_2 and H_2S

Item	Daily	3-Days	Weekly	Biweekly (every 2 weeks)	Monthly	Quarterly	Semi annually	Annually
Verify that displays on all instruments have values that are reasonable for current meteorological conditions and season			**X**					
Inlet free of impairment (i.e. bugs); no water in sample line.			**X**					
Compare time on system clocks to Air Quality Specialist watch that was recently compared to NIST time on internet; time accurate to ~1 min.			**X**					
Create plots of concentrations to include in SITC reports						**X**		**X**
Conduct Zero/Precision/Span Checks		**GOAL**		**REQUIRED**				
Conduct QC Checks	**GOAL**			**REQUIRED**				
Conduct Multi-point Verifications						**REQUIRED**		
Conduct Convertor Efficiency Checks				**GOAL**		**REQUIRED**		
Sky check: note and record sky conditions, unusual weather, instrument behavior			**X**					
Back-up data to SITC Server					**X**	**X**		
Replace Filters as necessary			**Check Filter**			**X**	**X**	**X**
Calibrate instruments. Repair / replace as necessary								**X**

Element 11 - SAMPLING METHODS (B2)

Monitoring methods and documentation that are applicable to the network are presented in this section. Continuous SO_2 and H_2S concentration measurements have been identified for the Swinomish Ambient Air Quality Program. The following sections summarize the methods to be used, more detail is provided in Swinomish SOPs, which are identified in Appendix C.

11.1 - **Hydrogen Sulfide and Sulfur Dioxide Monitoring**

Continuous monitoring of SO_2 and H_2S concentrations is conducted using a Teledyne-Advanced Pollution Instrumentation (TAPI) model T101 UV Fluorescent H2S Analyzer. The T101 is a T100 SO_2 analyzer outfitted with an SO_2 scrubber and heated converter which converts SO_2 and H_2S for detection by UV fluorescence. A switching valve allows the sample stream to bypass the scrubber and heated converter to measure SO_2 directly every 3 minutes. There is a wait period to flush the previous gas out of the sample chamber.

Each monitoring station is designed to maintain a sample flow that is clean and efficient, and to also maintain a consistent temperature for the optimum operation of the T101 analyzer. To meet these goals each analyzer 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 Pump at SAQMS1. 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 1-2 microns; and
- Nafion dryer to avoid water condensing in the sample line due to proximity to coastline.
- A rain shield installed to protect the inlet from taking in precipitation. Inlet is below the Rain shield.

11.2 - **CR1000 Data Logger with NL121**

The CR1000 has been set up to communicate with the T101, T700/146iQ, and T701/111iQ through ethernet utilizing a NL121 converter which allows older CR1000 models to work with ethernet. The CR1000 uses a local ethernet switch to communicate with the instruments using MODBUS protocols to control and receive output from the instruments. The CR1000 is programmed to control the T700/146iQ to create specific concentrations and deliver these at specific time intervals to minimize data loss and will automatically record the response of the gas analyzers. The CR1000 records five-minute ambient concentrations and operational states allowing us to track critical pieces of information and flag data based on instrument performance. The CR1000 is a programmable data logger that uses LoggerNet, a Campbell Scientific proprietary software. The PC LoggerNet software enables the operator communicate with the instrument and visualize real-time or historical data. Each Field personnel has LoggerNet downloaded on their Swinomish issued Laptop. Swinomish Laptops can

communicate with the datalogger via a direct connection via RS232 to USB-C or by connecting to the ethernet switch via an ethernet to USB-C connection.

11.3 - **Responsibilities**

In the table below, tasks are listed in regards to sampling method and the staff member(s) responsible for the tasks are marked. In general, AQ Specialist is the main driver of all in the field sampling and oversees the AQ Technician who assists in routine tasks. The AQ Analyst will support with higher level tasks to keep the L1 and L3 split for data quality reasons.

Table 11-1: Staff Responsibilities regarding the Sampling Methods of SO_2/H_2S

Task	AQ Analyst	AQ Specialist	AQ Technician	SITC IT
Procurement of consumables, maintenance kits, etc.			**X**	
Routine maintenance (replacing filters, inspecting/replacing sample lines, pump rebuilds, etc.)		**X**	**X**	
Routine QA/QC activities (that are no automated), data downloads, etc.		**X**	**X**	
Monitoring QA/QC results and data quality	**X**	**X**		
Identifying data anomalies, instrument problems (alarms), inventory needs	**X**	**X**	**X**	
Troubleshooting instrument issues, resolving QA/QC issues		**X**	**(assists)**	
Ensuring traceability of standards (Flow Meters, Gaseous standards, etc.)		**X**	**X**	
Determining how to resolve major instrument malfunctions, calibration needs, and data loss	**X**	**X**		
Troubleshooting communication issues	**X**	**X**		
Providing and ensuring connectivity for data collection	**X**			**X**
Coordinating for external audits and data reviews	**X**	**X**		

Element 12 - SAMPLE HANDLING (B3)

There are no field samples nor QC samples being collected as part of this monitoring program. All measurement data are generated by continuous instrumentation and transmitted digitally to a central database. Therefore, there are no sampling handling and/or chain of custody requirements.

Element 13 - ANALYTICAL METHODS (B4)

There are no samples being collected for laboratory analysis as part of this monitoring program. All measurement data are generated by continuous instrumentation and transmitted digitally to a central database. Therefore, there are no additional analytical methods to address.

Element 14 - QUALITY CONTROL REQUIREMENTS (B5)

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 air quality 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/analytical process;
- Assessing procedures used in the monitoring/analytical process 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 and lab procedures are producing acceptable data and are used to initiate appropriate corrective actions; therefore, QC is both proactive and corrective.

14.1 - SO_2 and H_2S Multipoint Calibrations/Verifications

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 3 additional verification points spaced along the calibration scale. In this way, the calibration scale represents the operating range of the analyzer and is inclusive of 1-pt QC and span checks.

14.1.1 - Multipoint Calibration Required/Recommendations

Calibration of continuous SO_2 and H_2S monitors, adjusting the zero and span values in the analyzer's internal calibration curve, are **required** as follows:

- upon initial installation,
- annually,
- relocation,
- When a Level One Span or One-Point QC Check exceeds ±15 percent, 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 SO_2 and H_2S monitors, adjusting 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 One Span or One-Point QC Check exceeds ±13 percent, and
- Observing increase response times to ZPS checks or decreasing ZPS results.

Gaseous SO_2 and H_2S monitors are manually calibrated remotely or at the station. The specific procedures for calibrating the T101 analyzer are provided in the T101 Instrument Manual. Logbook entries will be made documenting each manual calibration, and datalogger will be set to maintenance mode, flagging the data for exclusion from the ambient dataset.

14.1.2 - Calibration/Verification

A series of known concentrations (800 ppb, 400 ppb, 200 ppb, 70 ppb, 50 ppb, and zero air) of calibration gas is generated 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 run 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 analyzer's calibration linearity. All points of the calibration curve must be within ± 3%, or ±2.75 ppb, 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 calibration data, collected in the maintenance mode, will be stored in a separate table in datalogger onsite. Swinomish has also developed a Multipoint Calibration/Verification Template (See Gaseous Pollutant SOP Appendix) that automates the calculation process for multipoint calibration evaluation for SO_2 and H_2S. The analyzer response to all calibration points will be recorded when the SO_2/H_2S stability is below 1.0 ppb and entered into template. SO_2/H_2S concentrations, or data points, are recorded by the T101 every ten seconds. Stability is calculated by the analyzer as the standard deviation of H_2S concentration readings reported as the last 25 data points (accounting for approximately 1 minute and 10 seconds). Therefore, when the stability value displayed by the analyzer levels off at less than or equal to 1 ppbv for a period of at least 5 minutes, the variability in the measurement data is very low, indicating the analyzer response is stable, and the response should be recorded.

14.2 - SO_2/H_2S Level 1 Precision, Zero, and Span Checks

A Level 1 one-point zero/QC/span (ZPS) check of the continuous gaseous SO_2/H_2S analyzers is carried out at a minimum frequency of once every other week. At each monitoring station, the on-site digital acquisition system is configured to report the results of a Level 1 ZPS check on each gaseous pollutant monitor upon check completion. Results from these checks are flagged by the datalogger, automatically stored in separate tables in the data logger onsite. The goal is to have automated ZPS checks every three days where the onsite datalogger automatically initiate, conducts, and reports the 3-day ZPS checks.

Level 1 ZPS checks are conducted by subjecting the analyzer to test gas atmospheres at zero and two upscale known test gas concentrations (70 ppb and 800 ppb). For manual Level 1 ZPS,

the AQT or AQSp select the desired span level on the multi-gas calibrator and the datalogger is programmed to automatically recognize the change and flags/sorts data into the respective tables. For automated Level 1 ZPS checks, controlled by the timed program in the datalogger, the data logger is first set to QC mode, flagging the data for exclusion from the ambient dataset. Test gas is generated and is introduced through the calibration port of the inlet filter holder, via the inlet particulate filter, the sample line, the analyzer's internal particulate filter, and all other internal components used during normal sampling. The datalogger will record the analyzer response against span, QC point, or zero gas, when the SO_2/H_2S stability values are less than 1.0 ppb. Level 1 ZPS checks serve as:

- Verification on if/when to calibrate the analyzer
- Validation and invalidation of monitoring data

Any adjustments to the analyzer are preceded by an unadjusted manual ZPS QC check performed remotely wherein all test gas atmospheres are introduced to the analyzer through the sample probe inlet and the entire sample delivery line. Any adjustments to the analyzer are immediately followed by a ZPS QC check performed remotely. Acceptance criteria for each Level 1 check are defined previously, in Table 7-1 & 7-2, and again in Table 14-1 of this section. If the unit fails to meet acceptance criteria of the Level 1 checks, the cause will be investigated and the unit will be recalibrated, if needed. If the failed calibration checks are verified, ambient data will be invalidated back to the previous acceptable 1-point QC check.

14.3 - SO_2/H_2S One-Point Quality Control (Precision) and Zero Checks

A zero and single-point QC check (precision) of the continuous gaseous SO_2/H_2S analyzers is carried out at a minimum frequency of once every other week. At each monitoring station, the on-site digital acquisition system is configured to report the results of a precision check on each gaseous pollutant monitor upon check completion. Results from these checks are flagged by the datalogger, automatically stored in separate tables in the data logger onsite. The goal is to have automated precision checks every day where the onsite datalogger automatically initiate, conducts, and reports the daily precision checks.

The one-point QC check is conducted by challenging the SO_2/H_2S analyzer with a known test gas concentration (70 ppb), and the zero check is conducted by challenging the analyzer with zero air, generated by the T701 or 111iQ. The test gas atmosphere passes through the inlet particulate filter, sample line, the analyzer's internal particulate filter, and components used during normal sampling operations. No adjustments are made in conjunction with an automated one-point QC check. At the end of each sampling quarter, data obtained from the one-point QC check are used in calculations for data quality assessments of precision and bias for each analyzer. Acceptance criteria for one-point QC Check and Zero Check are defined in Table 14-1 of this section. If the unit fails to meet acceptance criteria of the Precision and Zero checks, the cause will be investigated and the unit will be recalibrated, if needed. If the failed calibration checks are verified, ambient data will be invalidated back to the previous acceptable 1-point QC check. Adjustments to the analyzer calibration are immediately followed by a similar manual ZPS QC check performed on-site or remotely. Refer to Figure 14-1, which details the decision-making and validation process for daily QC Checks.

14.4 - Precision and Bias Assessment for SO_2/H_2S Measurement Data

The goal for acceptable uncertainty of SO_2 and H_2S measurement data precision is defined as the upper 90 percent confidence limit for the coefficient of variation of 15 percent and for gaseous pollutant measurement data bias as the upper 95 percent confidence limit for the absolute bias of 15 percent. We have a goal to have the coefficient of variation for precision and bias to be less than or equal to 10 percent but recognize that having higher requirements are not necessary as this monitoring project is not for the enforcement of NAAQS. Refer to section Element 7 for detailed descriptions for calculating precision and bias.

14.5 - Converter Efficiency (H_2S only)

Ambient air passes through a scrubber, removing SO_2, and enters the heated catalytic converter. Therefore, the sample gas, as received by the converter, contains no naturally occurring SO_2. The converter is a heated stainless-steel chamber containing a molybdenum catalyst across which the sample gas passes just before introduction into the reaction cell. The catalyst converts the H_2S in the sample stream to SO_2 for detection by UV fluorescence. Therefore, by measuring the amount of SO_2 in the gas after it leaves the converter, the amount of H_2S originally present in the sample gas can be directly inferred.

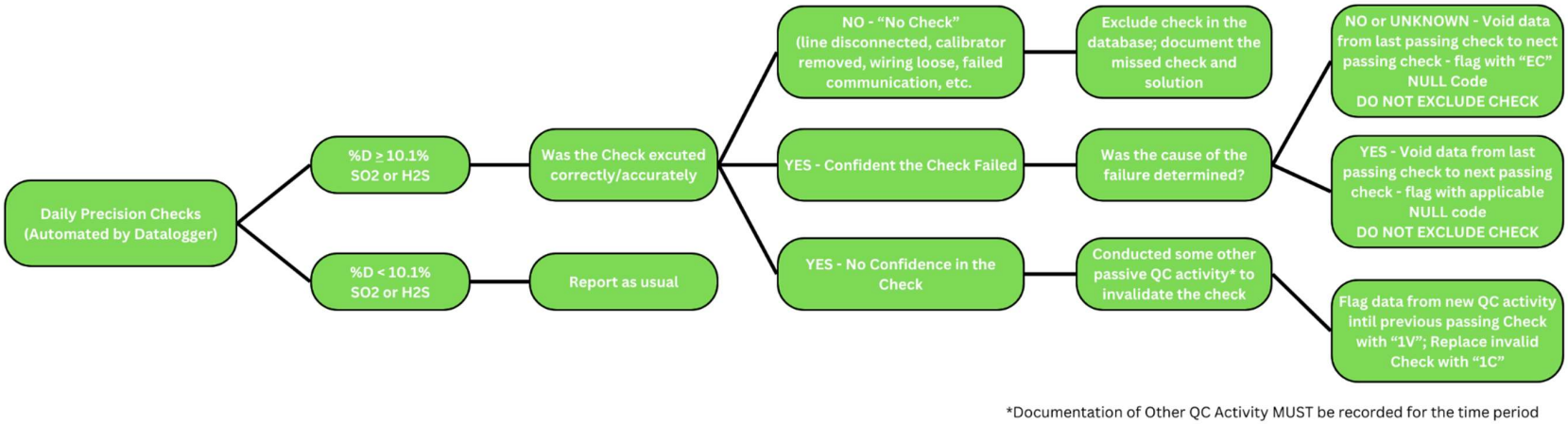
Converter efficiency should be tested at least every quarter (goal of testing every 14 days) and replaced if efficiency is less than 93% (goal: 96%), as referenced in Table 7-1 and 7-2 and Table 14-1. Testing converter efficiency is conducted by bypassing the SO_2 scrubber and converter, challenging the analyzer with a known concentration of SO_2. Then challenging the analyzer with the same concentration of H_2S, in normal operation, and comparing the analyzer's response to both challenge gasses. The procedure for conducting and documenting the converter efficiency test is included T101 Hydrogen Sulfide manual. The form used to document the results of the converter efficiency test is provided in Appendix B.

14.6 - Corrective Action

If any QC check fails or is > 12% different, instrument and calibrator diagnostics will be reviewed, the source of failure will be investigated, and calibration verified. If after investigation the manual QC check still fails, data will be invalidated back to the point of the last acceptable QC check. Such a failure would trigger corrective action reporting; see the Corrective Action Form Template for LabArchives attached in Element 26. Possible scenarios that would result in a Corrective Action Form:

- Determining that the sample line needs to be replaced or cleaned when the analyzer's response differs by more than 5% between introducing calibration gas through the sample train or directly into the instrument post filter change and conditioning.
- Adjustments to the analyzer calibration due to a failed or outside of tolerance (> 12%) QC Check, Span Check or MP Verification.
- Instrument flags that require replacement of instrument parts that are required or recommended to be followed by a verification/calibration. (Ex: replace Converter)

Figure 14-1: Decision-making and validation process for daily QC Checks



14.7 - **Independent Audits**

Assessment of the onsite SO_2 and H_2S monitoring is performed by quarterly performance and technical systems 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. Mr. David Meisters of AMSTech will be responsible for conducting performance audits (PA) of the onsite SO_2 and H_2S analyzers. During each audit test gasses as three concentration levels, plus zero will be generated to challenge the SO_2/H_2S analyzers. 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 7-1 & 7-2 and in Table 14-1 of this section.

Audit levels will be selected as follows:

- Level 1: lowest level to be tested, based on analyzer detection level
- Level 2, 3, or 4: TBD based on historical average ambient concentrations
- Level 5, 6, or 7: TBD based on historical maximum concentrations and action limits

If an analyzer exceeds audit limits at any level, an immediate precision/span/zero 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.

(Table 14-1 on next page)

Table 14-1: QAQC Summary for SO_2 and H_2S Monitoring

Monitoring Instrument	Type of Check	Purpose of Check	Minimum Frequency	Acceptance Criteria
SO_2/H_2S Analyzers	Routine Instrument Checks and Preventive Maintenance	Verifies and documents operational status indications of analyzer & support equipment. Includes performance of routine preventive maintenance in accordance with instrument-specific needs and schedules.	Bi-Weekly	Monitor-specific criteria established for operating status indicators
	Zero & One-Point QC (Precision) Check	Used to assess the precision and bias of the data based on variability of responses over time. 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 One-Point QC Checks on a daily basis)	≤ ±15% of True value (GOAL: ≤ ±10% of True value)
	Level 1 Zero/One-Point/Span Check	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 Level 1 Checks on every 3-day basis.)	Zero drift by <=±4.6 ppb (24 hrs) OR <=±7.6 ppb (>24hr-14 days) span drift <=±15.1 % (GOAL: Zero drift by <=±3.1 ppb (24 hrs) OR <=±5.1 ppb (>24hr-14 days) span drift <=±10.1 %)
	Multi-point Calibration	Establishes and/or verifies linear calibration relationship between known test gas concentrations and analyzer responses across the measurement range. NOTE: multi-point calibrations will be performed only manually on-site; calibrations will NOT be performed using automated or remote access methods.	Upon initial installation, Every quarter thereafter. Multi-point calibrations will consist of a zero point and four upscale, non-zero test gas concentrations. (Note: Latest EPA Guidance does not require quarterly calibrations. Recommendations are not to calibrate if QC checks are passing.)	Zero Point: ≤ 7.5 ppb; Non-Zero Points: all fall within 3% (or an absolute difference) of the calibration scale, best fit straight line. (GOAL: Zero Point: ≤ 5 ppb; Non-Zero Points: all fall within 2% (or an absolute difference) of the calibration scale, best fit straight line.)
	Independent Performance and Systems Audit	Performance Audit: Confirms quarterly bias assessments of measurement data	Quarterly, each monitoring station	EPA audit levels 4-10: Percent difference ≤ ±15% EPA Audit levels 1-3: difference of ≤ +1.5 ppb or percent difference Audit concentrations at a minimum of 3 levels not including zero.
	Converter Efficiency	Verifies conversion of H_2S to SO_2 in the sample gas for detection by UV fluorescence.	Quarterly (GOAL: Bi-Weekly manual Check)	Replace converter if efficiency < 93% Prefer to replace when < 96%
Gas Dilution System	Gas Dilution Check	Verification of mass flow controllers	Semi-annually	Accuracy +/-2%
Zero Air System	Zero Air Check	Verification of zero air generation	Annually	Concentrations are <0.2 ppb

Element 15 - INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE (B6)

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

Specific tasks for periodic testing, inspection, and maintenance are required for the air sampling and monitoring equipment to provide sufficient quality control to remain within the manufacturer's operating specifications and ensure that the project quality goals are met.

Initial testing of each piece of equipment is conducted by SITC at SAQMS1 for operation within the manufacturer's specifications. All reference standards are traceable to the National Institute of Standards and Technology (NIST). The operational checks include testing the measurement systems of each piece of sampling/monitoring equipment.

Following the routine maintenance schedule, as outlined in Table 15, is necessary to avoid contamination and ensure the instruments are operating properly. Additionally, operations and maintenance procedures are outlined within SITC's Gaseous Pollutant SOP in Element 26.

Table 15-1: T101 H_2S Analyzer Routine Maintenance Activities

Activity	**Frequency**	**Responsibility**	**Comments**
Replace inlet filter	Monthly	SITC	Disassemble filter holder and replace with a new filter
Clean sample inlet	Quarterly, or as needed	SITC	Disassemble and clean
Flow calibration	Annually	SITC	Following pneumatic system maintenance
Replace Thermal Catalytic Converter	Annually or as Needed	SITC	When converter efficiency ≤ 93% (prefer 96%)
Sample Line Integrity Checks	As Needed	SITC	For troubleshooting, reduced response to H_2S
Replace orifice filter	Annually	SITC	Annually or if flow < specified
Replace SO_2 Scrubber	Quarterly	SITC	Check response to SO_2
Rebuild sample pump	Annually	SITC	Annually or if flow < specified

Documentation of site activities are provided through the use of multiple forms including the site log books, site visit check sheets, maintenance and repair activities, and emails as well as calibration records.

Table 15-2 presents an inventory of spare parts and expendable items that will be maintained on site for the duration of this monitoring program.

Table 15-2: Inventory of Spare Parts and Expendables

Item	**Inventory at Each SAQMS with H_2S**
T101 pump rebuild kit	1
T101 and T700, Expendables Kits, 6-month Supply (filters, etc.)	1
H_2S Converter	1

Element 16 - INSTRUMENT CALIBRATION (B7)

Calibrations are performed according to SITC's SOPs, the T101 operations manuals and the T700U or 146iQ operation manuals outline the details for calibrating the T101 analyzer and T700U/146iQ gas dilution system, respectively. All calibration equipment are in current certification and traceable to the National Institute of Standards and Technology (NIST) or the appropriate authoritative standard. Certification records of the SO_2/H_2S gas standards used for routine QC checks are maintained electronically on the SITC Server.

Certification of project specific gas standards and audit gas standards are maintained by the AQA and are valid for a period of three years. Certifications of Audit gas standards are included within the auditor's reports. Calibrations and certifications are performed by trained and experienced field scientists and technicians. Calibration equipment, as required, may be sent to the manufacturer or a facility equipped and qualified to perform traceable calibrations.

The T101 will receive maintenance and calibration verification (multi-point checks) by the AQSp every quarter.

Additionally, calibration checks, and verifications will be performed as follows:

- SO_2 /H_2S Measurements
  - Multipoint calibration at program start;
  - Additional multipoint calibrations, if determined necessary;
  - At least once per 14 days 1-point calibration verification (70 ppb); and
  - At least once per 14 days zero/precision/span checks (zero, 70 ppb, and 800 ppb).
- Gas Dilution System
  - Leak Checks conducted annually, or after maintenance;
  - Mass Flow Controllers calibrated annually, using NIST traceable primary flow standards; and
  - Following the maintenance schedule identified in the operation manual of the T700U or 146iQ, respective of what instrument is at the station.

Calibrations will be performed at the start and end of the monitoring program, and as deemed necessary based on QC activities.

Element 17 - EQUIPMENT, SUPPLIES, AND CONSUMABLES (B8)

Spare parts in Table 17-1 and consumables were obtained from the original equipment manufacturer and will be located at the site or at the DEP Office. The SITC Air Quality Technician is responsible for maintaining an inventory of these items. In the event additional parts or supplies are needed, they will be procured from the instrument manufacturer by the Air Quality Tech where they will be inspected prior to deployment by the Air Quality Specialist. On a monthly basis, the Air Quality Technician to the Air Quality Analyst the status of all spare parts and consumable items. The Air Quality Technician and Air Quality Specialist will be responsible for ordering all parts, supplies and materials, as required, to meet the requirements of this program. The Air Quality Analyst is responsible for ensuring that these parts and supplies meet the specifications of the instrument manufacturer allowing all instrumentation to be operated in compliance with this QAPP.

17.1 - **Gaseous Standards**

Standard gaseous mixtures of SO_2 in Nitrogen and H_2S in Nitrogen are required for precision, ZPS, multi-point, and conversion efficiency checks. SITC purchases compressed gasses from Praxair. Compressed gasses used for calibration are EPA Protocol Gasses and come with certification of purity. Compressed gasses should be replaced every 3 years (if not sooner). The specifics on the EPA Protocol Gasses SITC uses are listed in Table 17-1.

Table 17-1: Gaseous Standards Required to be at an SAQMS with SO2/H2S Monitors

EPA Protocol Gas	**Cylinder**	**Volume**	**Pressure**
H_2S 50 ppm Balanced Nitrogen	High Pressure Aluminum AS Style Cylinder	141 ft^3	2000PSIG
SO_2 50 ppm Balanced Nitrogen	High Pressure Aluminum AS Style Cylinder	141 ft^3	2000PSIG

At one station there should be an additional cylinder of both SO_2 and H_2S that are EPA Protocol Gasses that can be utilized by the contractor to complete external audits on all stations that monitor SO_2 and H_2S. These should also be replaced every 3 years (if not sooner).

17.2 - **Zero Air Generator Scrubbers**

In order to dilute the standard gasses, a zero-air cylinder or zero air generator (ZAG) are required for precision, ZPS, multi-point, and conversion efficiency checks. Due to the cost of storing zero air, it is better to use a ZAG. The ZAG scrubbers are consumable and must be replaced. These consumable scrubbers are listed below in Table 17-2.

SITC has three models of ZAGs: Thermo Fisher 111iQ, Teledyne T701, and an Environics ZAG (used for back-up only). The ZAGs models match the Multi-gas calibrator model at the SAQMS.

Table 17-2:Zero Air Generator Scrubbers

Model of ZAG	**Consumable**	**Model Number**	**Est. Change Out Time**
Thermo Fisher 111iQ	Purafil (Media, Chemical Filter, Bottled) Charcoal (Charcoal, Bottled)	7075 4158	Monthly/As Needed Yearly
Teledyne T701	T701 Maintenance Kit (Includes Charcoal, Purafil, Molecular Sieve, o-rings, etc.)	015980000	Annually

Element 18 - NON-DIRECT MEASUREMENTS AND EXTERNAL DATA (B9)

In the event of an emergency release or detection of levels greater than 75 ppbv of SO_2 or 70 ppbv of H_2S, the AQA will look at external data or models to aid Emergency staff to determine the best course of action. The models or external data are described in the following three sections.

18.1 - **NRMC WRF Model**

18.1.1 - Model Description

The Northwest Regional Modelling Consortium (NRMC) operates high-resolution environmental prediction models over the Pacific Northwest. NRMC is sponsored by a consortium of local, state, and Federal agencies including Swinomish Indian Tribal Community. For this project, we utilize model products from the Weather Research and Forecasting (WRF) Model. University of Washington (where model products are produced) runs the Advanced Research WRF (WRF-ARW) core version 4.1.3. The following is an overview of WRF-ARW model specifications:

1. The WRF forecasts currently feature an outer grid of 36 km horizontal resolution that covers much of western North America and the northeastern Pacific; a nested grid of 12 km resolution that covers Washington, Oregon, Idaho, Utah, much of Montana and Nevada, southern British Columbia, and northern California; and an inner 4 km resolution grid encompassing all of Washington, Oregon, and Idaho plus the western third of Montana and the extreme northern sections of California, Nevada, and Utah, and the western third of Wyoming. A high-resolution 4/3-km domain is also run which covers Washington, Oregon, the western portion of Idaho, and the extreme southern 40-50 km of British Columbia. **Error! Reference source not found.** depicts the 4/3-km domain range and the terrain height used.
2. The WRF- ARW model utilizes 38 vertical full-eta levels. Eta-levels are comprised of a systematic mixing of two vertical coordinate systems: pressure coordinates and terrain-following (i.e. sigma) coordinates. Eta-levels are a purely pressure coordinate at the top and upper levels of the model atmosphere, they then transitions to a hybrid pressure-sigma coordinate at mid- to low-levels, and finally to a terrain-following sigma coordinate at the lowest few levels and model surface.
3. In order to initialize all the necessary meteorological variables for each grid, two different model runs are performed.
    a. One utilizes initial and lateral boundary conditions for an older MM5 (Fifth-Generation Penn State/NCAR Mesoscale Model) run that are generated by interpolation of the National Centers for Environmental Prediction (NCEP) "NAM" (formerly the ETA) model analysis and forecast fields. This MM5-NAM run only includes the 36 and 12 km domains.
    b. The second initialization uses NCEP's GFS (Global Forecasting System) model (formerly known as AVN or MRF) at 0.5-degree lat/lon resolution for nearly all fields. The exceptions are: 1) SST is from the 1/4 degree OTIS grids, 2) surface

temperature and 3-D moisture fields are from the Rapid Update Cycle (RAP) 130 grids where available.

i. Alternatively, when the RAP 130 grids are unavailable, surface temperature is from the NAM/ETA 221 grids (40-km grid spacing), and 3) subsurface soil temperature and moisture are also from NAM/ETA 221 grids.

4. Forecasts are computed as follows:
   a. MM5-NAM: 4-processor Intex Xeon Linux box.
   b. WRF-GFS: Eight 20-processor Intel Xeon cluster running Debian Linux .
5. Currently, the model is run for 84 hour forecast period for the 36, 12, and 4-km domains. For the 4/3-km domain, it is run for 60 hours. An extended run to 180 hours is also run for the 36 and 12-km domains. The MM5-NAM finishes in roughly 22 minutes of wallclock time, while the WRF-GFS finishes in roughly 1.75 hours of wallclock time for the 36/12/4 and 4 hours for the 4/3-km domain.
6. Forecasts are produced twice a day.

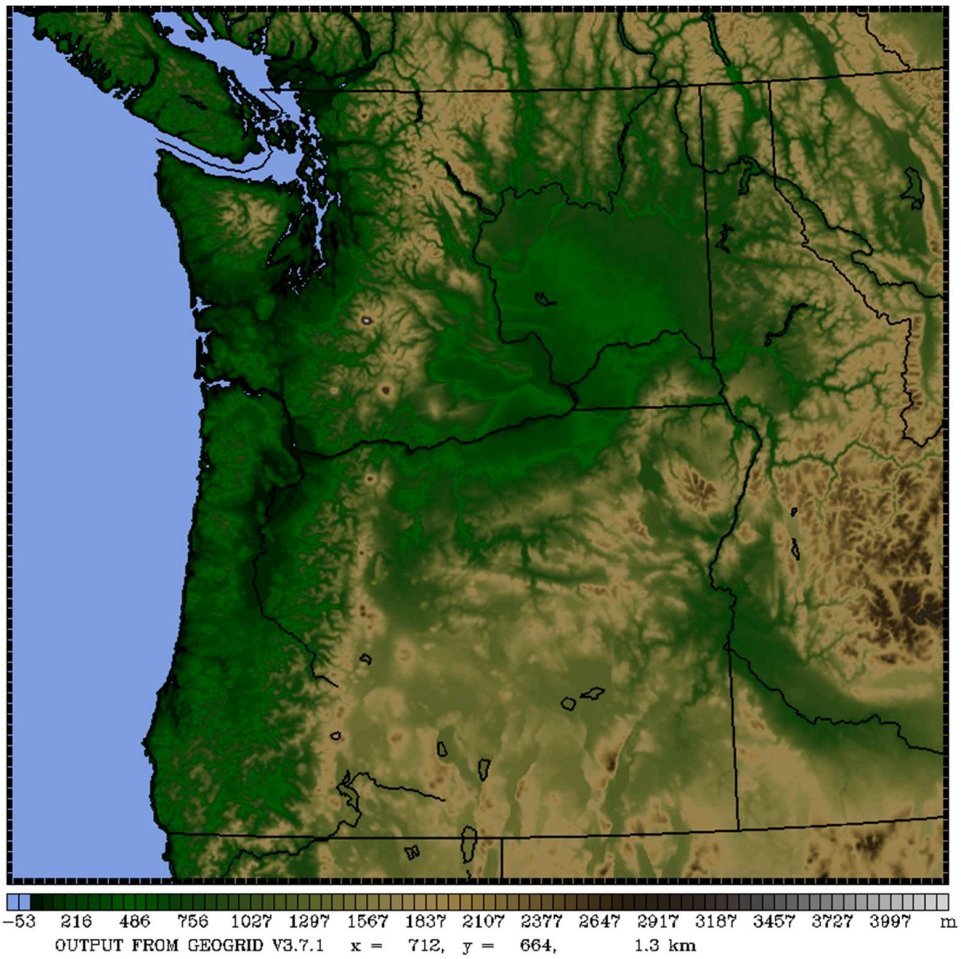
18.1.2 - Model Selected

The WRF-ARW is the highest resolution model for the Puget Sound region at the 4/3-km and 38 eta-levels with multiple days of forecast. The Puget Sound region weather is highly impacted by terrain effects (i.e. Conversion Zone, Rain Shadows, etc.) that can only be captured with good terrain resolution. The WRF-ARW model is managed and implemented by one of the most prominent Research Universities in Atmospheric Science. UW staff are constantly updating the WRF model to include the most accepted physics schemes to ensure best performance. Thus, the WRF-ARW model is the best choice for any study within the 4/3-km domain.

In addition, the WRF-ARW is easily accessible for Tribal Nations. As the NRMC is supported by the EPA's Region 10 office, Tribal Governments can request model determined soundings at any location of interest in the 4/3-km grid domain. Swinomish has already requested that the Swinomish Village (48.39°N, 122.5°W) be including in the many sounding plots. These soundings are easily accessible at: https://a.atmos.washington.edu/wrfrt/rt/soundings_d4.cgi?timeindep

In addition, as the refineries are a large Title V source, NRMC already computes forward trajectories from the Anacortes refineries using the 4-km Nest. These trajectories can be found by going to the following website (https://a.atmos.washington.edu/wrfrt/data/timeindep/gfsinit.aq.html#1%201/3km) and scrolling down to the orange colored section labeled "4km Other Forward Trajectories." These trajectories are done in post-processing using the plotting program RIP (version 4.7). RIP interpolates to the location of the trajectory to determine the velocity of an air parcel in that area. The velocity and time step are used to determine the new position 10 minutes later. The routines run by UW linearly interpolated from the hourly model product to calculate the velocity at the new location.

Figure 18-1: WRF 4/3-km Domain Terrain Height Map



18.1.3 - Model Use

The WRF soundings and trajectories will be used to determine weather conditions during the Emergency release event. This information will be used in conjunction with real-time data and other models to predict trends in concentrations of pollutants (will increase, remain the same, decrease) over the course of the next hour, two hours, three hours, etc.

18.2 - **Hybrid Single-Particle Lagrangian Integrated Trajectory Model**

18.2.1 - Model Description

The National Oceanic and Atmospheric Administration (NOAA)'s Air Resource Laboratory (ARL) provides access to computing servers to run the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) Model. If you register with NOAA, you have access to the dispersion version of the model that release user selected number of particles.

The online HYSPLIT portal allows the user to select the weather model of choice. For Our purposes, we utilize the High-Resolution Rapid Refresh (HRRR) Model. The following is an overview of HRRR model specifications:

1. The Rapid Refresh (RAP) Model is the continental-scale NOAA hourly-updated assimilation/modeling system operational at 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 3-km resolution, hourly updated, cloud-resolving, convection-allowing atmospheric model, initialized by 3km grids with 3km radar assimilation. Radar data is assimilated in the HRRR every 15 min over a 1-h period adding further detail to that provided by the hourly data assimilation from the 13km radar-enhanced Rapid Refresh. Figure 18-2 depicts the 3-km range of the CONUS region with the radars marked in open circles. This is solely to depict range.
3. The 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.

18.2.2 - Model Selected

The HRRR is the highest resolution model for the CONUS 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 - like Python.

18.3 - **Northwest Clean Air Agency and Department of Ecology Monitoring**

During an emergency release event, we will also look to the NWCAA and DOE's monitoring posted at https://enviwa.ecology.wa.gov/home/map which allows one to view the hourly concentrations of $PM_{2.5}$ and SO_2 at the nearby Bartholomew Road and 2nd Ave sites (see Figure 18-3). This will help to monitor the extent of the release and if the winds are shifting towards Reservation if concentrations are high starting at 2nd Ave 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).

Figure 18-2: HRRR 3-km CONUS Domain with Reflectivity and radars marked with open circles.

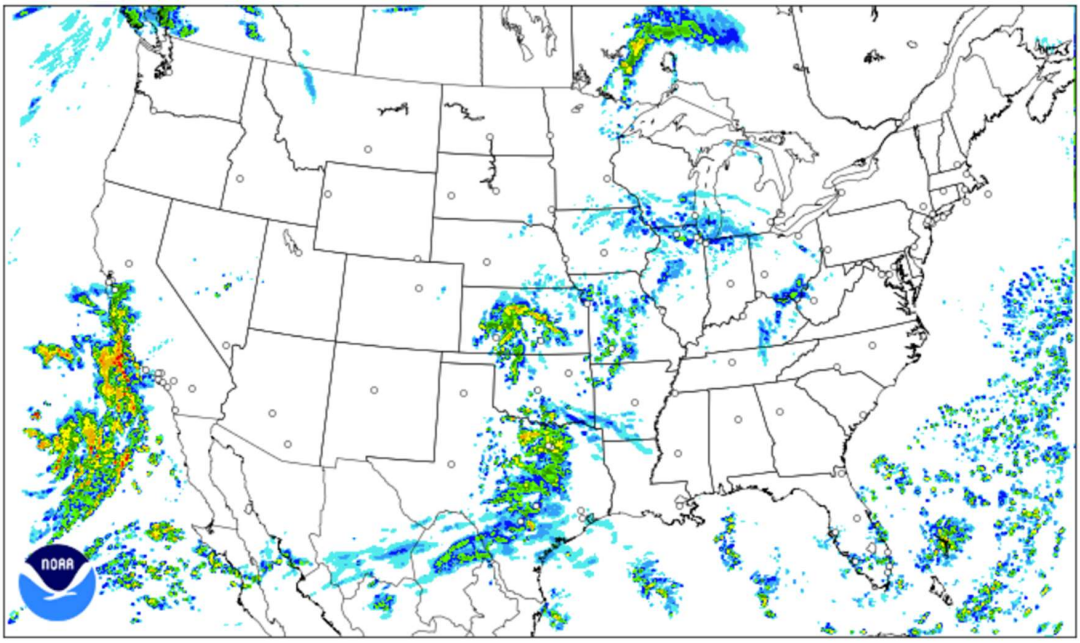
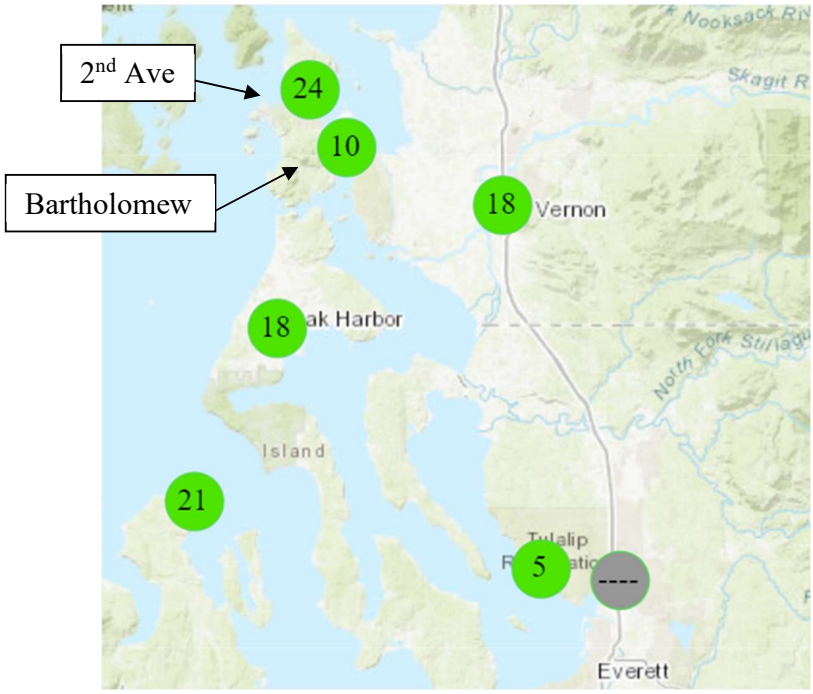


Figure 18-3: Locations of 2nd Ave and Bartholomew Road Sites on DOE's Interactive Map



18.3.1 - Model Use

The HYSPLIT dispersion trajectories will be used to determine most probable locations of atmospheric transport during the Emergency release event by tracking the locations of 10000

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 (will increase, remain the same, decrease) over the course of the next hour, two hours, three hours, etc.

Element 19 - DATA MANAGEMENT (B10)

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 both of these areas, quality assurance 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 values reported (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/invalidity. This information must be available months or years after the data were gathered, which requires a rigorous and consistently-followed system and documentation.

19.1 - **Data Recording**

The SO_2/H_2S analyzers as well as the meteorological sensor data collection system utilize a Campbell Scientific Model CR1000 data logger with NL121 Ethernet adapter. For SO_2 and H_2S, the 1 second data is polled directly from the Teledyne T101 SO_2/H_2S analyzers and averaged into a 5-minute table in the CR1000. Data can be downloaded from LoggerNet. Goal is to have data sent to the datalogger to be sent to a real-time website and AQS. We will contract with Campbell Scientific and utilize QREST (Quality Review and Exchange System for Tribes) to accomplish this goal. The details of data recording are detailed in the Swinomish Data Management Plan. This will be updated yearly to include the changes to our data storage system as we create our own historical data SQL database, work with Campbell scientific to automate data downloads, utilize QREST for AQS uploads, and develop a real-time website using input from emergency response personnel and community members.

19.2 - **Data Transmittal**

Data transmittal is accomplished using direct connection to the datalogger. 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. For this program, automated alerts will be sent via email to project personnel when a 30-minute averages of H_2S concentration exceed 70 ppbv.

19.3 - **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 DDEP.
- Password protection on the database. Only DEP staff can access database.

- Server and individual computer password changes (quarterly for continuing personnel; passwords for outgoing personnel will be cancelled immediately);

19.4 - **Data Validation**

The instrument-generated data are stored on the Swinomish Network or on DEP staff Computers, currently. Currently, we do not have automated data verification. The first data verification step is performed manually by searching the data download for status flags and comparing reported values to acceptable range criteria of critical diagnostic parameters. Status flags are applied at the time of data logging; either autogenerated by the logger program or applied manually after download.

The use of status flags in performing data validation is addressed in Swinomish Data Management Plan, 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. 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. Currently, the qualified data is processed via excel to create Excel Files; we are working hard to make this a part of either a SQL database we are developing for our internal reporting or working with QREST.

If the data quality indicators 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 and SC DHEC.

19.5 - **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 any and all templates for ZPS checks, etc. are created and finished post visit (filled in with raw tables of QC data from the datalogger). These are automatically updated to the LabArchives cloud (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 eLogbooks are uploaded to the SITC server; this does not include the revision history; eLogbooks will not be deleted from LabArchives until at least 5 years has passed. Site documentation is reviewed as part of the data validation process.

When the 5-minute data is downloaded using LoggerNet, the staff member completing the download must make an eLogbook Page for the download noting the data files downloaded. The data 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. Additionally, 5-minute data is downloaded from the analyzer during every biweekly site visit. Reports and site records are saved directly to the SITC server and are backed up automatically by the SITC IT department. A final validated dataset will be prepared manually as previously stated. The data will be stored in excel data sheets with final data validation flags. Changes to this process are expected; see the most recent Swinomish Data Management Plan for details.

ASSESSMENT AND OVERSIGHT (Group C)

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, II, and IV.

Assessments are performed by:

- Field Technical Systems Audits
- Field Performance Assessments
- Data Quality Assessments

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 - **Field Technical Systems Audits**

The quarterly performance audit includes a review of monitoring equipment siting, site visit logs, and adequacy of station operations. The audits are conducted yearly by an independent contractor and results will be included in the annual reports to DEP and the EPA. During each audit, the analyzer will be operated in the normal sampling mode, with the audit test gas introduced at the inlet of the sample line and passing through all filters and components used during normal sampling operations. The audit levels will be chosen based on the ambient concentrations for each station since the prior audit. Audit results will be documented on a standard audit report form for continuous gaseous pollutant analyzers.

20.2 - **Field Performance Evaluations**

Performance assessments will be performed as part of routine maintenance and calibration. Before any maintenance or adjustments are performed on monitoring equipment an "As Found" audit is performed to document the operational accuracy of the instrument. The results of the "As Found" audit document the accuracy of the measurements up to that point in time. The measurements will be presented separately in the calibration reporting documents.

20.3 - **Data Quality Assessments**

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the data meet the assumptions that the DQOs and data collection design were developed under and whether the total error in the data is tolerable. Calculations for DQA

activities shall follow the requirements and equations identified in 40 CFR Part 58, Appendix A, Section 4. The DQA process is described in detail in Data Quality Assessment - A Reviewer's Guide (EPA QA/G-9R). Terminology associated with measurement uncertainty is found within 40 CFR Part 58, Appendix A. Estimates of the data quality will be calculated on a quarterly basis.

20.4 - **Network Reviews**

The network review is a review conducted at least every five years and is used 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. This review is drafted by the AQSp and AQT, and reviewed by the QA Reviewer and the WRM, supported by the US EPA Region 10 office.

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

- Network files (including updated site information and site photographs)
- Air quality summaries for the past five years for the monitors in the network
- Emissions reports such as the NEI or NATTs or Modelling studies such as the NATA.
- Changes in scientific understanding of health impacts of CAPs or HAPs
- Hindcasts for each abnormal event through HYSPLIT.

The AQSp begins the review by obtaining the required information, and updating files and/or photographs that are more than a year old. During the network review, the stated objective for each monitoring location or site (see Element 10 (B1)) are reconfirmed and the spatial scale re-verified and then compared to each location to determine whether these objectives can still be attained at the present location. An on-site visit will include 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. Since many of these conditions will not change within one year, this evaluation at each site is performed every 5 years.

Other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- Installation of new monitors
- Relocation of existing monitors
- Citing criteria problems and suggested solutions
- Problems with data submittals and data completeness
- Maintenance and replacement of existing monitors and related equipment
- Quality assurance problems
- Air quality studies and special monitoring programs
- Other issues, such as community concerns
- Proposed regulations, and
- Funding

A report of the network review is written within two months of the review and appropriately filed (Element 9 (A9)).

Element 21 - REPORTS TO MANAGEMENT (C2)

21.1 - **Reports**

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**
Quarterly Data Report	AQA and AQSp	Environmental Data Section (Includes DDEP)	1/quarter, usually in 2nd month of quarter
Final Data Validation Report	QA Reviewer	AQSp, ECM, DDEP	1/quarter; after quarterly report within 14 days
EPA Quarterly Reports	AQA, AQSp	Destiny Hollowed	1/quarter; 30 days after quarter ends
EPA Annual Reports	AQA	Destiny Hollowed	1/year; 90 days after year ends
SITC DEP Annual Reports	AQA and AQSp	DDEP	1/year; 60 days after year ends

21.2 - **Final Data Validation Report**

The Data Validation Checklist (Element 26) serves as the Final Data Validation Report is completed by the QA Reviewer after the completion of the QAQC Checklist. The report consists of:

1. Location of eLogbooks on Network (ensuring the eLogbook was downloaded)
2. Data processed manually or automatically; templates or SQL database updated.
3. Summary of findings from QAQC Checklist,
    a. Issues (if any) encountered in database entry
    b. Issues (if any) with traceability (MFCs, protocol gases, etc.)
    c. Issues (if any) encountered in ZPS and multipoint checks
    d. Recommendations for future data management

DATA VALIDATION AND USABILITY (Group D)

Element 22 - DATA REVIEW, VERIFICATION AND VALIDATION (D1)

This section describes how the Swinomish AQ Program verifies and validates data collection operations. Verification is conducted as an ongoing process through regular SOP referral, careful logging of field/database operations, and evaluating both parameter and QC data as it is available (i.e., not waiting until data review is scheduled but reviewing data as it is available). Validation consists of "stepping back" from the process and evaluating whether the data we are gathering are useful for our purpose.

The major objective for the Swinomish AQ Program in this project is to monitor concentrations of ambient SO_2 and H_2S from the refinery to inform emergency management personnel during hazardous releases of unknown chemicals. This section will describe the verification and validation activities that occur at the important data collection phases. Earlier elements of this QAPP describe in detail how the activities in these data collection phases are implemented to meet the data quality objectives. Review and approval of this QAPP by the personnel listed on the approval page provide initial agreement that the processes described in the QAPP, if implemented, will provide data of adequate quality.

In order to verify and validate the phases of the data collection operation, the Swinomish AQ Program uses qualitative assessments (e.g., technical systems audits, network reviews, internal assessments) to verify the QAPP is being followed and relies on the various quality control checks. These are inserted at various phases of the data collection operation to ensure that the data will meet the DQOs.

Data verification and validation is conducted by the QA Reviewer and is reviewed by the AQA, WRM and/or DDEP. Any issues that require corrective action are identified and logged in the form of memos to AQA or AQSp and corrective action is conducted and documented. Such communications are logged as part of the data review process in the database logbook and validation report.

All information that is relevant to support the determination of validity of the data is included in the final data validation report and file package.

22.1 - **Sampling Design**

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

- 40 CFR Part 58, Appendix A - Quality Assurance Requirements for Monitors Used in Evaluation of National Ambient Air Quality Standards; and
- 40 CFR Part 58, Appendix E - Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring.

Additional guidance is provided in *Guidance for Choosing a Sampling Design for Environmental Data Collection.* (EPA QA/G-5S).

As described in the Site Management Plan, in keeping with the monitoring program objectives, the monitors are located a) near source for advance warning, and b) in the most populous region of the reservation (to be established). The monitoring locations provide comprehensive spatial coverage with respect to evaluating risk to the community.

22.2 - **Data Acquisition and Transmission**

All raw continuous data from the monitoring stations are retrieved via LoggerNet either through a direct or Ethernet connection. Raw data is also stored on the analyzers' data acquisition system. Weekly, the AQSp reviews the previous week's data file and verifies the daily precision checks of the SO_2/H_2S analyzers.

The AQSp uses the Teledyne analyzer internal data acquisition system or Campbell Scientific datalogger to backfill any missing data files. These data are the raw data collected from the datalogger and are considered "Level 0" data. These data are used to monitor instrument operations on a regular basis but are not used for reporting until subject to further review and validation. Level 0 data files are kept intact and unedited. These data are not subject to reduction or reformatting.

22.3 - **Quality Control**

Element 14 specifies the QC activities that are to be performed during the ambient monitoring program. These include calibrations, QC checks, assessments, 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.

22.4 - **Calibration**

Element 16 addresses the calibration of the SO_2/H_2S 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, any data produced between the suspect calibration event and any subsequent recalibration should be flagged to alert data users.

Element 23 - VALIDATION AND VERIFICATION METHODS (D2)

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 Data Management Plan. Database verification uses the limits which are detailed in this QAPP as Table 7-4 and 7-5 for SO_2 and H_2S, respectively, 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 and 7-5 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 and 7-5 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 (ALS staff, local air quality agencies, US EPA) is sought to add to the evidence supporting validity.

Systematic criteria listed in Table 7-4 and 7-5 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.

Templates for quarterly verification and annual validation were created based on EPA templates for L1 and L2 verification review and L3 validation reviews. These templates are attached in Element 26.

Element 24 - RECONCILIATION WITH USER REQUIREMENTS (D3)

In order to set probability limits on decision errors, the Swinomish AQ Program 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.

Our program uses a coefficient of variation between samples to determine acceptability and ensure quality control. The Measurement Quality Objectives and associated acceptance criteria are outlined in Table 7-2.

24.1 - **Quantitative**

The following questions are posed during the final data review process, at least annually, by the AQSp, the QA Reviewer, and the ECM. 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 (SO_2 NAAQS, H_2S mRLs and ASILs)? For example, if our data show consistent values near the standard, we may want to investigate an additional monitoring site in another location.
- Were our action limits set at the correct levels? Should we investigate developing tribal standards that are different from the ASILs?
- 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 (technological developments, new building 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?

24.2 - **Qualitative**

Element 24 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 and 7-5 for SO_2 and H_2S, respectively. This section of the QAPP will outline the procedures the Swinomish AQ Program will follow to determine whether our 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 Swinomish AQ Program 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 our action limits. For example, when the MRLs from the CDC,, ECUs and/or RfCs, or WA policy (ASILs) are updated, we may want to ensure that our internal reporting policies stay consistent with the most recent information.
- New monitoring objectives that require changes to standards. Integrating new sample locations? Developing sampling for emergency response (wildfires, refinery emissions)?

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;
- US EPA guidance is updated;
- the Swinomish community expresses heightened interest;
- we form a partnership with nearby air monitoring agencies who can assist with independent assessments, data review, etc.;
- ***Example:*** do we want to monitor SO_2 for the enforcement of the NAAQS based on our monitoring results?

Other QA considerations include:

- Is there a preventable condition causing data to be unusable or lost?
- Were the quality control criteria (Table 7-4 and 7-5 for SO_2 and H_2S, respectively) used to validate the data appropriate to meet quality objectives? Should criteria be loosened to save resources or tightened to meet the DQOs?

Element 25 - REFERENCE LINKS

EPA Reports/Guidance Documents

EPA Best Practices for Review and Validation of Ambient Air Monitoring Data

EPA QA Handbook Ambient Air Monitoring Volume II: Ambient Air Quality Monitoring Program

Additional Reference Links:

Teledyne API T101 Manual (2016)

Teledyne API T101/T102 Manual (NumaViewTM; 2020)

Teledyne API T700 Manual

Teledyne API T701 Manual

ThermoFisher 146iQ Manual

ThermoFisher 111iQ Manual

Element 26 - APPENDIX

Appendix A – Gaseous Pollutant SOP

- Appendix A: Quality Control Check e-Logbook page Template
- Appendix B: Quality Control Check Form
- Appendix C: Zero, Precision, and Span Check e-Logbook page Template
- Appendix D: Zero, Precision, and Span Check Form
- Appendix E: Calibration/Validation e-Logbook page Template
- Appendix F: Calibration/Validation Form

Appendix B – Data Validation Template

Appendix C – Data Verification Template

Appendix D – LabArchives SOP

Appendix E – Campbell Scientific Loggers and Loggernet Software SOP

Appendix F – Gas Dilution System 1-point QC Check e-Logbook page Template

Appendix G – Gas Dilution System 1-point QC Check Form

Appendix H – Gas Dilution System Multipoint QC Check e-Logbook page Template

Appendix I – Gas Dilution System Multipoint QC Check Form

Appendix J – Corrective Action e-Logbook page Template