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

DISCRETE SAMPLING OF
Volatile Organic Compounds (VOCs)

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

8/9/2021

Prepared by Kelsey Larson and Caitlin Roberts

Category 1 QAPP

PROJECT MANAGEMENT (Group A)

ELEMENT 1 - TITLE AND APPROVAL (A1)

X Vice Chair

Steve Edwards
Swinomish Senate Chairman

X

Todd Mitchell
Environmental Director

X

Caanan Cowles
Environmental Compliance Director

X Kelsey E Larson

Kelsey Larson
Air Quality Specialist

X Caitlin Roberts

Caitlin Roberts
Air Quality Technician

X

Jason Thompson
Quality Assurance Data Reviewer

X Shannon B. Stewart

Shannon B. Stewart
Quality Assurance Data Reviewer

X Raymond Wu Digitally signed by Raymond Wu
Date: 2021.09.14 09:50:47 -07'00'

Donald Brown
EPA R10 Quality Assurance Manager

ELEMENT 2 - CONTENTS

2.1 - Figures

2.2 - Tables

2.3 - Acronyms & Abbreviations

µg/m3 – microgram per meter cube (Concentration unit)
ALS – Australian Laboratory Services
ALS PM – ALS Project Manager
AQ – Air Quality
AQSp – Air Quality Specialist
AQT – Air Quality Technician
ASIL – Acceptable Source Impact Level (From Washington State Code)
BFB - Bromoflourobenzene
CAP – Criteria Air Pollutant
Carcin. – Carcinogenic Classification (For Table 5-1)
Cardio. – Cardiovascular system, including heart and circulatory (veins, arteries) (For Table 5-1)
CAS # - Chemical Abstracts Service Registry Number
CCV – Continuing Calibration Verification
CDC – Center of Disease Control
CFC – Chlorofluorocarbon
CFR – Code of Federal Regulations
CQCC - Canister Quality Control Check
CV – Coefficient of Variation
DEP – Department of Environmental Protection
Der./Ocul. – Dermatological or Ocular (skin or eyes) (For Table 5-1)
DQF – Data Quality Flags
DQO – Data Quality Objectives
EC – Estimated Long-term Concentration Exposure
EICP – Extracted Ion Current Profile
EMC – Environmental Compliance Manager
EPA – Environmental Protection Agency
FB – Field Blanks
FC – Flow Controller
GC – Gas Chromatography
GC/MS – Gas Chromatography and Mass Spectrometry
GFS – Global Forecasting System
HAP – Hazardous Air Pollutant
HQ – Hazard Quotient
ICAL – Initial Calibration Standard
ICV - Initial Calibration Verification Standard
IRIS - Integrated Risk Information System
ITEP – Institute for Tribal Environmental Professionals
LCS – Laboratory Control Standard
LD – Laboratory Duplicate
LIMS – Laboratory Information Management System
MB – Method Blank
MDL – Measurement Detection Limit
MQOs – Measurement Quality Objectives
MRL – Method Reporting Limit
mRL – Minimum Risk Levels; lower caps needed for differentiation. In most contexts the “m” is capitalized. Changed this as other SOPs are referenced with “MRL” meaning Method Reporting Limit
MS – Mass Spectrometry
NAM - North American Mesoscale Forecast System
NATA – National Air Toxic Assessment
NATTs – National Air Toxic Trends
NCEP – National Centers for Environmental Prediction
Neuro. – Neurological System (For Table 5-1)
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)
NWR – Niwot Ridge, Colorado Sampling site
OSHA – Occupational Health and Safety Administration
PMALS – Project Manager at ALS Simi Valley
ppbv – parts per billion by Volume (Mixing Ratio unit)
ppm – parts per million (Mixing Ratio Unit)
psig – Pounds per square inch in Gauge (measured relative to ambient pressure)
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
RAP – Rapid Update Cycle
Repro./ Devel. – Reproductive System or Development (For Table 5-1)

Resp. – Respiratory system including nose, throat, lungs (For Table 5-1)
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.
RPD – Relative Percent Difference
RRT – Relative Retention Time
RSD – Relative Standard Deviation
SAQMS – Swinomish Air Quality Monitoring Station
SCAN – Mode of MS; between 34 to 280 amu
SIM – Mode of MS; scan based on target analytes
SITC – Swinomish Indian Tribal Community
SMO – Sample Management Office for ALS Simi Valley
SOP – Standard Operating Procedure
TAP – Toxic Air Pollutant (used in Washington State Law)
TO-15 – Total Organic – 15 (EPA approved Method using GC/MS to determine concentrations of VOCs in air)
URE - Inhalation Unit Risk Estimate for Carcinogenic Risk
Urin./Diges. – Urinary or Digestive System (For Table 5-1)
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
Caanan Cowles	SITC	DEP Environmental Compliance Manger	ccowles@swinomish.nsn.us
Kelsey Larson	SITC	DEP Air Quality Specialist	klarson@swinomish.nsn.us
Caitlin Roberts	SITC	DEP Air Quality Technician	croberts@swinomish.nsn.us
Jason Thompson	SITC	DEP Water Quality Specialist	jthompson@swinomish.nsn.us
Shannon B. Stewart	SITC	DEP Water Resource Analyst	sbuckham@swinomish.nsn.us
Arlene Dilts-Jackson	SITC	Compliance; Grant Administrator	adiltsjackson@swinomish.nsn.us
India Young	EPA Region 10	Tribal Office, Project Manger	young.india@epa.gov
Raymond Wu	EPA R10	EPA R10 Quality Assurance Chemist	Wu.raymond@epa.gov
Hayden Akers	Environmental USA (ALS Laboratory)	Project Manager	Hayden.Akers@alsglobal.com

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 - *Environmental Compliance Manager, Caanan Cowles*

Major QA related responsibilities of the Environmental Compliance 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 Specialist, Kelsey Larson*

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

- Maintaining regular communication with contractors, EPA, and project staff, and ensuring adherence to this QAPP by staff
- Writing and revising this QAPP, SOPs, and all supporting documents such as QC forms and checklists
- Responsible for data quality
- Providing answers to technical questions
- Ensuring that reviews, assessments and audits are scheduled and completed
- (At times) conducting or participating in QA activities
- Tracking the results of QC checks, calibrations, and audits
- Recommending necessary corrective actions
- Serving as the program's QA liaison with EPA Regional QA Managers.
- Preparing and delivering data completeness and summary reports, and

4.1.4 - *Air Quality Technician, Caitlin Roberts*

The Air Quality Technician (AQT) is responsible for:

- Carrying out the work in the field and ensuring the gathered data meet the requirements of this QAPP.
- Supporting AQSp to write and revise this QAPP and SOPs
- participating in training and certification activities
- verifying that all required site visits, maintenance, and routine QC checks are performed and documented.
- 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 AQSp
- flagging suspect data
- Entering data into database

4.1.5 - *QA Data Reviewers, Jason Thompson and Shannon B. Stewart*

Responsibilities of the QA Data Reviewer (QADR) include:

- Reviewing this QAPP, SOPs, and all supporting documents such as QC forms and checklists
- 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.

4.2 - Support Contractors

Contractor support in this project bears the bulk of the analysis and QA/QC procedures. As we do not have the equipment or instruments to analyze samples at SITC we have contracted with ALS Laboratories (Environment USA) to supply clean 6 L aluminum canisters, extract the VOC sample, analyze the sample, run QA/QC checks on their lab equipment, and report results in accordance with EPA Method TO-15. The contacts at ALS are as follows:

4.2.1 - *Project Manager, Hayden Akers*

- Ensuring all ALS SOPs related to Method TO-15 analysis are adhered to in all Laboratory Activities
- Documenting any deviations from SOPs
- Contact AQSp if samples received are suspect
- Overviewing all QA/QC documents and putting together a “Case Narrative”

4.3 - 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

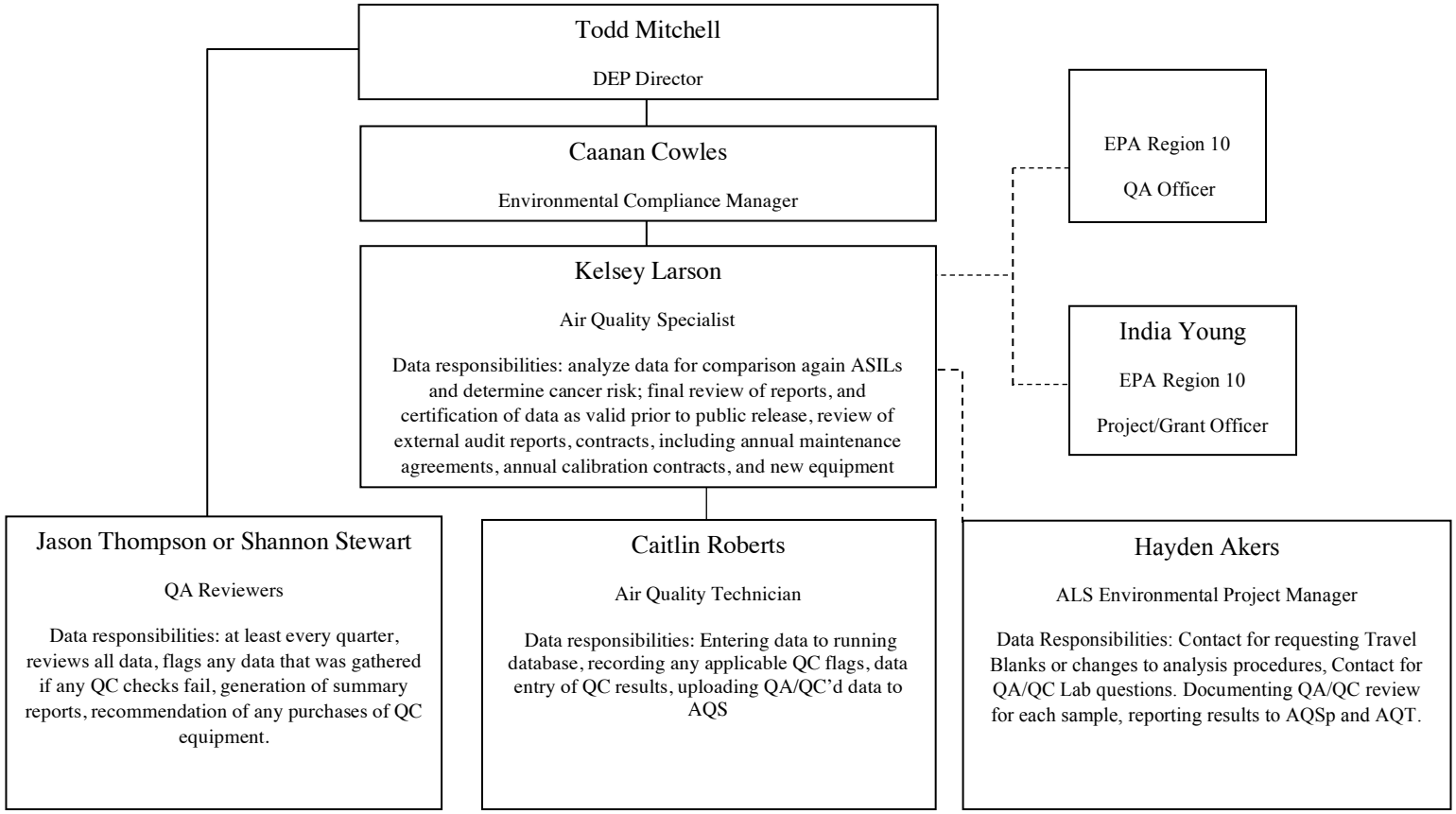
4.3.1 - *US EPA Air Monitoring and Quality Assurance Specialist,*

- Reviewing and approving this QAPP

4.3.2 - *US EPA Project Manager, India Young*

- 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 Swinomish Indian Tribal Community (SITC) is concerned with two aspects of air quality on the Swinomish Reservation – adverse human health impacts and cumulative ecological impacts. Tribal members have a higher than normal incidence of respiratory diseases such as from asthma and allergens (source: Swinomish Climate Change Initiative). The Swinomish Medical Clinic reports that respiratory distress is one of the top three reasons ambulances are called to the Reservation. Additionally, the Swinomish people are the People of the Salmon. Fishing and gathering is not only a source of income for many members, but a cultural practice. Environmental degradation, especially impacting coastal waters, threatens the Swinomish way of life.

The Swinomish Air Program was established in 1999 focusing on indoor air quality and monitoring Criteria Air Pollutants (CAPs). In the late 1990s, SO_2, NO_x, and Ozone were a main concern as we were a non-attainment zone. Since then, ambient concentrations have decreased to be in compliance with the National Ambient Air Quality Standards. However, while the CAPs have decreased, the Swinomish community is still concerned about CAA violations that have occurred at the nearby refineries. In February 2015, a release of chemical-laden fumes from Shell's Puget Sound Refinery 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 safety procedures not being followed, these actions we not taken based on the concentration 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." On 9/29/2021 another refinery release event occurred. Luckily, the event did not last as long as the 2015 event; however, this highlights the continued need for HAPs sampling and revitalized public interest.

In response, our 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. The objective of this program is to 1) monitor ambient VOCs/HAPs concentrations from Refinery emissions, 2) monitor ambient VOCs/HAPs on the Reservation to better understand health impacts from VOCs/HAPs, 3) establish the baseline of VOCs/HAP concentrations on Reservation, and 4) report findings to local, state, and federal agencies.

Due to the easily portability of the Summa Canisters, the sampling locations could be any area of interest; for consistency and comparability, we will sample at the Swinomish Air Quality Monitoring Stations (SAQMS) where both CAPs and meteorological data are collected. The rationale for these location(s) can be found in Section 10.

This QAPP describes project methods, refers to EPA-established data quality objectives, and defines data quality assurance and control methods for our air sampling. The QAPP was developed to ensure consistent, repeatable results and to improve the reliability and comparability of data collected. We are adopting the full 24-element format QAPP required by a level 1 QAPP (Appendix C of the QA Handbook, Vol. 2) because the data we gather will be used for regulatory purposes. In a letter from the EPA on 11/4/2020 in regards the 2015 incident, the EPA stated: "Although we definitely understand that the February 2015 release impacted the Tribe and other nearby communities due to the particular mix of chemicals and the meteorological conditions at the time, 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." This project seeks to provide additional

information by creating a baseline of refinery influenced air for future comparisons if such an even occurs again and implementing a QA/QC'ed sampling regime that can be replicated in response to another such event.

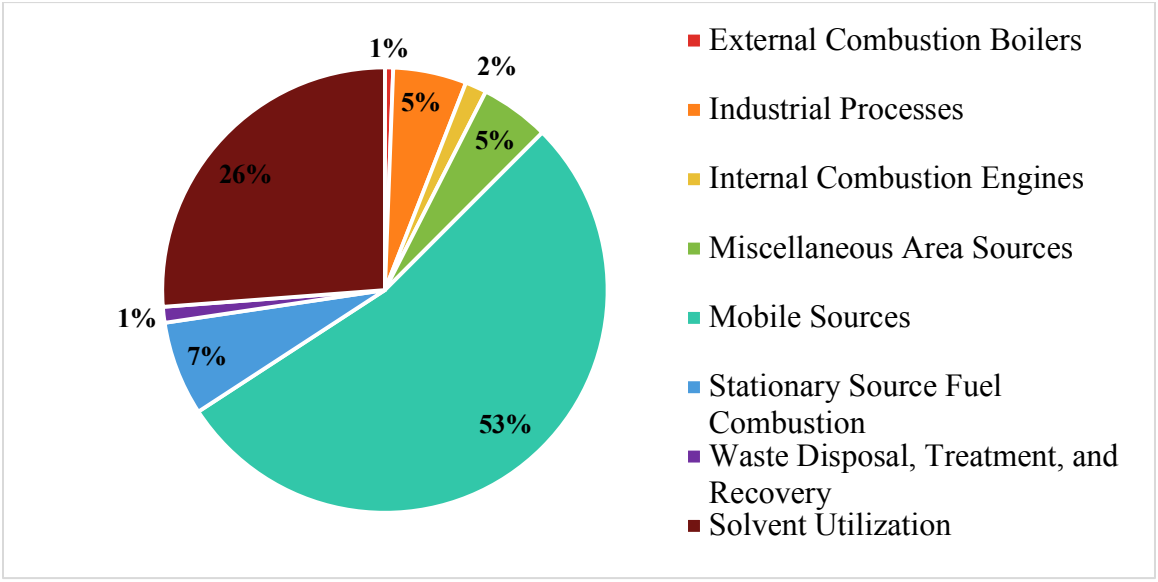
In the following section (A5.1) will outline general sources and emissions of VOCs and HAPs on or near Reservation. Section A5.2 will indicate the relevant health impacts of HAPs/TAPs monitored using Method TO-15 and any toxicological measurements used as reference.

5.1 - Volatile Organic Compounds (VOCs)

5.1.1 - *Sources*

Volatile Organic Compounds (VOCs) are any compound that includes hydrogen and carbon that have a high vapor pressure at ordinary room temperature – i.e. they evaporate easily. VOCs are numerous, varied, and include both anthropogenic (human-made) and naturally occurring compounds. Anthropogenic VOCs are highly regulated, particularly those used in confined spaces. In addition, some are classified as Hazardous Air Pollutants (HAPs) due to adverse health impacts from both acute or long-term exposure. Due to the number of different VOCs, the VOCs studied in a particular area are highly dependent on the source. Sources of VOCs range from vegetation (> 75% of VOCs in Skagit County), incomplete combustion of fossil fuels, industrial production of chemicals, industrial uses of solvents, wildfires or wood burning, and commercial cooking – as shown in Figure 5-1.

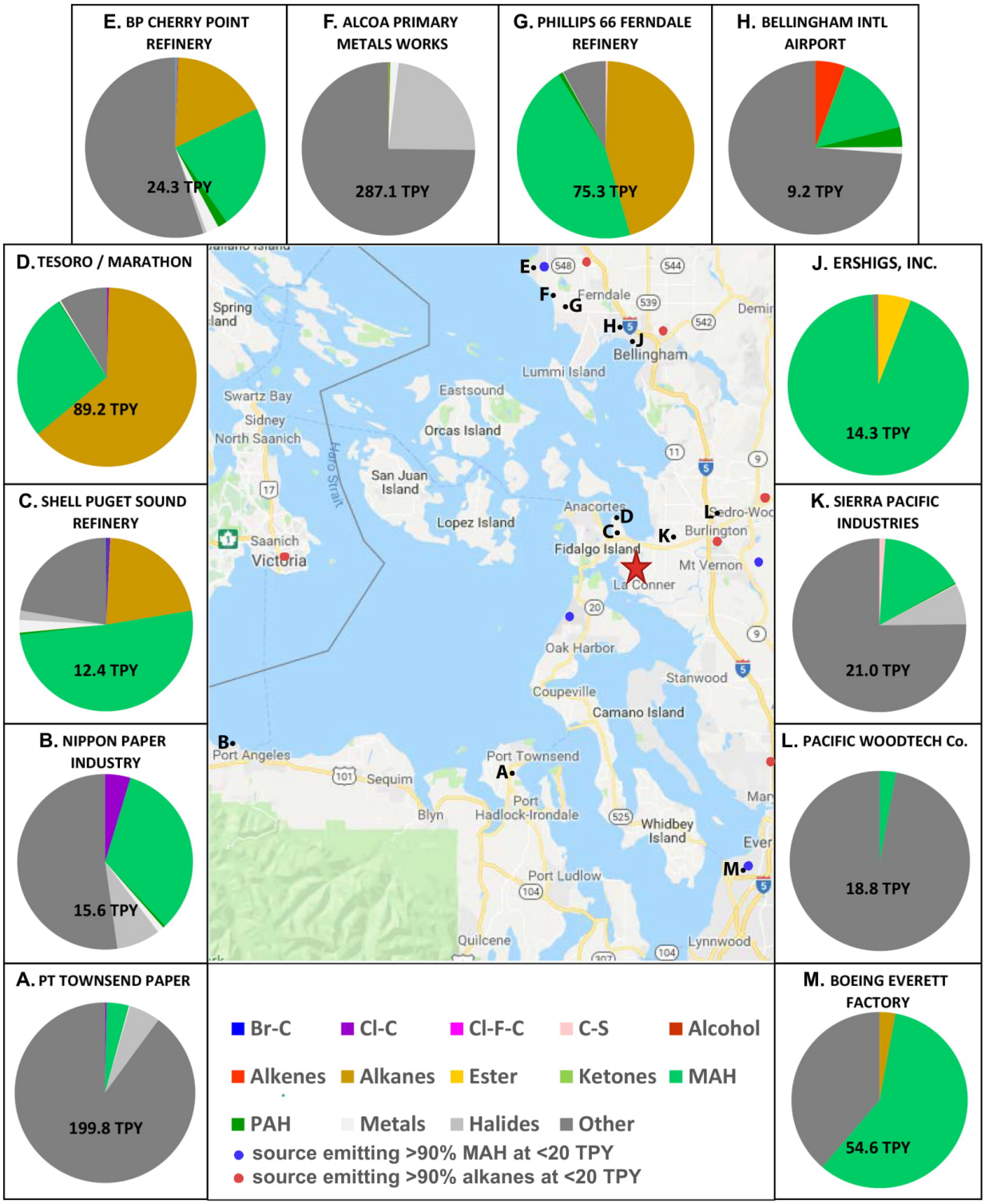
Figure 5-1: Anthropogenic VOC Sources in Skagit County
Total: 5,737 Tons/Year (Note: Biogenic Sources of VOC total 16,910 Tons/Year)



Some VOCs are classified as Hazardous Air Pollutants (HAPs) or Toxic Air Pollutants (TAPs) in either federal or state laws. The National Air Toxics Assessment (NATA) aims to create an ongoing review of air toxics in the United States to help local, state, and federal agencies identify which pollutants, emission sources and places they may wish to study further to better understand any possible risks to public health from air toxics. The 2014 NATA is the most recent version and lists 70 different HAPs. Some of these are compounds that are not detected via Method TO-15. This is either due to being in the particulate phase or the compounds are reactive with the walls of the stainless-steel canisters and thus aren't captured with TO-15 analysis. Examples of such compounds are all aldehydes, hydrogen sulfide, and hydrochloric acid.

To make sure that we are capturing a large fraction of known HAPs/TAPs emissions from the refineries, we researched the HAPs emissions using the 2014 NATA. The emission breakdowns for nearby sources is detailed below in Figure 5-2.

Figure 5-2: The NATA 2014 HAPs Emission Totals and Breakdown of Nearby Sources by Category



5.1.2 - *Health Impacts*

In this QAPP, we will be using the Total Organic Method 15 (TO-15, further described in section A6) that utilizes Gas Chromatography and Mass Spectrometry (GC/MS) to determine the concentration of 75 different VOCs. Of those VOCs, 44 of them are classified as HAPs and are listed in Table 1 with their individual impacts on the respiratory, cardiovascular, liver/kidney/digestive, neurological systems and their carcinogenic potential.

Table 5-1: HAPs Detected by Method TO-15 and their Health Impacts on Different Body Systems and Classification as a Carcinogen.

Name*	Resp.	Cardio.	Der./Ocul.	Urin./Diges.	Neuro.	Repro./ Devel.	Carcin.
1,1,2,2-Tetrachloroethane							
1,1,2-Trichloroethane							
1,2,4-Trichlorobenzene							
1,2-Dibromo-3-chloropropane (DBCP)							
1,3-Butadiene							
1,3-Dichloropropene (trans and cis)							
1,4-Dichlorobenzene							
1,4-Dioxane (1,4-Diethyleneoxide)							
Acetonitrile							
Acrolein							
Acrylonitrile							
Allyl Chloride (3-Chloro-1-propene)							
Benzene							
Benzyl Chloride							
Bromoform							
Carbon Disulfide							
Carbon Tetrachloride							
Chlorobenzene							
Chloroform							
Cumene							
Ethyl Chloride (Chloroethane)							
Ethylbenzene							
Ethylene Dibromide (1,2-Dibromoethane)							
Ethylene Dichloride (1,2-Dichloroethane)							
Ethylidene dichloride (1,1-Dichloroethane)							
Hexachlorobutadiene							
Methyl Bromide (Bromomethane)							
Methyl Chloride (Chloromethane)							
Methyl Chloroform (1,1,1-Trichloroethane)							
Methyl Ethyl Ketone (MEK) (2-Butanone)							
Methyl Methacrylate							

Methyl tert-Butyl Ether							
Methylene Chloride (Dichloromethane)							
Naphthalene							
Hexane							
Propylene Dichloride (1,2-Dichloropropane)							
Styrene							
Toluene							
Vinyl Acetate							
Vinyl Chloride							
Xylenes (3 isomers o, m, and p)							

Key	
	Enough Evidence to indicate impact on system in humans/Classified as Carcinogen
	Limited evidence of impact on animals, limited human studies/Possible Carcinogen
	No evidence present/Not Classified as Carcinogen

* Resp. = Respiratory system including nose, throat, lungs
Cardio. = Cardiovascular system, including heart and circulatory (veins, arteries)
Der./Ocul. = Dermatological or Ocular (skin or eyes)
Urin./Diges. = Urinary or Digestive System
Neuro. = Neurological System
Repro./ Devel. = Reproductive System or Development
Carcin. = Carcinogenic Classification

ELEMENT 6 - PROJECT DESCRIPTION (A6)

6.1 - Project Summary

The measurement goal of monitoring VOCs/HAPs/TAPs through discrete sampling and GC/MS analysis is to monitor the concentration, in units of micrograms per cubic meter ($\mu g/m^3$) and parts per billion volume (ppbv), of 75 different VOCs in ambient air coming from the refineries at March Point. The method used to determine the concentration of these VOCs is the EPA TO-15 Method "Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS)" (EPA/625/R-96/010b). The method is a manual sample collected either over 24 hours utilizing stainless steel canisters with sub-atmospheric pressure and flow controllers. The canisters are both cleaned and supplied by ALS and returned ALS for GC/MS analysis to determine the concentrations of VOCs. SITC is responsible for collecting the sample.

6.1.1 - *VOC Schedule Overview*

The QC measurements are under the purview of ALS and further described in element 14. All valid data must be bracketed by passing QC checks (before and after, in accordance with the schedule in element 14). Samples will occur at least once a week and within 10 days. This will be enforced through having a forecast schedule; the forecast will occur every 6 days. Sampling will occur within 72 hours of the forecast initialization (5:00 am PST). At least every quarter, the data will undergo the final data validation process (see Element 14).

6.1.2 - *Design/Performance Specifications*

Table 6-1: Design/Performance Specifications - Air Canister Sampler - Volatile Organic Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Canister Design Specs. Size Medium Max Pressure Max Pressure drop Collection efficiency Lower Detection Limit	1 in 10 days; once per week	 6L spherical Passivated SUMMA electropolished Stainless Steel Canister 30 psig vacuum 14 psig 99% Compound specific; usually > 0.1 ppbv	

6.2 - Laboratory Activities

Laboratory activities for the air toxics program include preparing the canisters for the routine field operator, which includes three general phases:

6.2.1 - *Pre-Sampling*

- Receiving canisters from the vendors;
- Checking sample integrity;
- Storing canisters
- Packaging canisters for field use;
- Associated QA/QC activities;
- Maintaining microbalance and analytical equipment at specified environmental conditions;
- Equipment maintenance and calibrations.

6.2.2 - *Shipping/Receiving*

- Receiving canisters from the field and logging into database;
- Storing canisters;
- Associated QA/QC activities.

6.2.3 - *Post-Sampling*

- Checking canister integrity;
- extraction of VOCs from canisters;
- Analysis of samples extracted;
- Cleaning canisters;
- Associated QA/QC activities.

Specific information demonstrating the location(s) of sampling that meet our objectives and the rationale for the location(s) can be found in Section 10.

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 VOC/HAPs/TAPs monitoring through EPA's Total Organics – Method 15 (TO-15). We have followed the steps to develop DQOs and MQOs which are outlined in the following sections.

7.1 - DQO Evaluation

7.1.1 - Stating the problem

The populace on the Swinomish Reservation are located within 3 miles of two refineries at March Point. The Shell Refinery 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, "resulting in strong odors that reached the Swinomish Reservation, the City of La Conner, and surrounding areas."[1] This resulted in more than 100 community members reporting health impact and multiple people to seeking medical attention. On September 29, 2020 a similar release occurred that is now under investigation by the NWCAA.

Because of the reoccurrence of these events, the community seeks more information on the exposure to HAPs from these refineries both chronically and during large emission events. The nearest NATTs monitoring station that captures Hazardous Air Pollutants is in Seattle, WA. Seattle is an urban area with large influences from transportation (highways, ports, etc.) and industries. Swinomish is more rural; thus, will have more influences from fertilizer and pesticides in addition to specific industries (oil refineries) and transportation (highways, ports, rail, etc.). In addition, NATTs goals are seeking baseline trends while Swinomish is particularly interested in HAPs from specific sources. Thus, the NATTs site isn't representative of the Swinomish Reservation and cannot be used for our purposes.

7.1.1 - Identifying the decision

1. The results will be compared 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.
2. After accumulating a full year of data, we will compute yearly averages and compared to 1-year ASILs and Chronic 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

[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

the Senate for determination of next steps. Next Steps could include reporting ASIL or mRL exceedances to the NWCAA.

3. The total excess Cancer Risk and total Hazard Quotient from HAPs monitored will be calculated using EPA supplied toxicological indexes every year using the annual average. These will be reported to DEP management.
4. The results will be assessed to decide whether additional monitoring should be pursued. For example, if we should expand to take samples at the same time as NATTs while monitoring the refineries or if we should include TO-11 analysis to capture aldehydes.

7.1.2 - Identify the inputs to the decision

The type of data needed is defined by the intended use of the data, and the inputs to the decision are the data that are gathered. At this point the only other data gathered for this project will be other SITC AQ and weather monitoring as well as model outputs Northwest Regional Modelling Consortium (NRMC) Weather Research Forecast (WRF) Model to determine sample timing. Model products used include:

- Temperature Vertical Profiles
- Forecast trajectories from the March Point Refineries
- 3-hr Precipitation forecasts for WA state

For determination of excess Cancer Risk, Hazard Quotient or exceedance of either ASILs or MRLs, all relevant information is shown in Table 7-1.

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. The temporal boundary is that at least a full 24-hour sample for comparison against certain ASILs and MRLs. A full year is required to determine longer term health impacts. Multiple years will be useful for understanding trends and long term health impacts.

7.1.4 - *Deciding on a decision rule*

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

This project is adopting similar precision measurement quality objects as the NATTs program. The MQOs developed for SITC are detailed in Table 7-2 with the NATTs MQOs in Table 7-3 for comparison. In order to account for wind direction, unlike the NATTs program we do not have set sampling days with the requirement for 1-in-6 day sampling. Besides that specific difference, our MQOs are comparable to the NATTs in terms of Precision, Bias, and Completeness.

7.1.6 - Optimizing the design

The design has been optimized to fit the budget and the needs of the tribe. Priority has been placed on the objectives presented in Element 6, and using a method that can determine HAPs concentrations of a number of emitted compounds from nearby sources. If further information is gathered, or if the situation changes (such as development of housing or schools in a different area) then the plan will be changed and this QAPP will be revised and reissued for review and approval.

Table 7-1: Classification of 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[2] (1/ug/m3)**	**RfC (mg/m3)**	mRL (ppm)	Factor	mRL (ppm)	Factor	mRL (ppm)	Factor	8-hr REL	Unit[3]
1,1,1-Trichloroethane [71-55-6]	Y	Y	5.00E+03	24-hr	I	5.00E+00			0.7	100	2	100	1900	mg/m3
1,1,2,2-Tetrachloroethane [79-34-5]	Y	Y	1.70E-02	year	Oral Only				Oral Only				35	mg/m3
1,1,2-Trichloroethane [79-00-5]	Y	Y	6.30E-02	year	1.60E-05	Oral Only			0.002	30	0.03	270	45	mg/m3
1,1-Dichloroethane [75-34-3]	Y	Y	6.30E-01	year	C	N							400	mg/m3
1,1-Dichloroethene [75-35-4]	N	Y	2.00E+02	24-hr	C	2.00E-01	0.0006	30	0.001	30			50	ppm
1,2,4-Trichlorobenzene [120-82-1]	Y	N			D	Oral Only	Oral Only		Oral Only					
1,2,4-Trimethylbenzene [95-63-6]	N	Y	6.00E+01	24-hr	I	6.00E-02								
1,2-Dibromo-3-chloropropane [96-12-8]	Y	Y	3.20E-04	year	N	2.00E-04			0.0002	100			1	ppbv
1,2-Dibromoethane [106-93-4]	Y	Y	1.70E-03	year	3.00E-04	6.00E-04	9.00E-03						20	ppm
1,2-Dichloro-1,1,2,2-tetrafluoroethane [76-14-2]	N	N											7000	mg/m3
1,2-Dichlorobenzene [95-50-1]	N	N			D	Oral Only	Oral Only		Oral Only		Oral Only		300	mg/m3 (C)
1,2-Dichloroethane [107-06-2]	Y	Y	3.80E-02	year	2.60E-05	N	0.6	90					50	ppm
1,2-Dichloropropane [78-87-5]	Y	Y	1.00E-01	year	N	4.00E-03			0.002	30	0.02	90	350	mg/m3
1,3,5-Trimethylbenzene [108-67-8]	N	Y	6.00E+01	24-hr	I	6.00E-02								
1,3-Butadiene [106-99-0]	Y	Y	3.30E-02	year	3.00E-05	2.00E-03							1	ppm
1,3-Dichlorobenzene [541-73-1]	N	N			D	N			Oral Only		Oral Only			

[2] I = Inadequate info, N = Not Assessed, B2 = Probably Carcinogen based on Animal evidence, C = Possible Carcinogen, D = Not Classifiable as Human Carcinogen, E = Evidence of non-carcinogenicity for humans

[3] (C) = Ceiling

			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[2] 1/(ug/m3)**	**RfC (mg/m3)**	mRL (ppm)	Factor	mRL (ppm)	Factor	mRL (ppm)	Factor	8-hr REL	Unit[3]
1,4-Dichlorobenzene [106-46-7]	Y	Y	9.10E-02	year	N	8.00E-01	0.01	30	0.2	100	2	10	450	mg/m3
1,4-Dioxane [123-91-1]	Y	Y	2.00E-01	year	5.00E-06	3.00E-02	0.03	300	0.2	30	2	10	360	mg/m3
2-Butanone (MEK) [78-93-3]	Y	Y	5.00E+03	24-hr	I	5.00E+00					1	100	590	mg/m3
2-Hexanone [591-78-6]	N	Y	3.00E+01	24-hr	I	3.00E-02	Oral Only						410	mg/m3
2-Propanol [67-63-0]	N	Y	3.20E+03	1-hr	N	7.00E+00							980	mg/m3
3-Chloro-1-propene [107-05-1]	Y	Y	1.70E-01	year	C	1.00E-03							3	mg/m3
4-Ethyltoluene [622-96-8]	N	N												
4-Methyl-2-pentanone [108-10-1]	N	Y	3.00E+03	24-hr	I	3.00E+00							410	mg/m3
Acetone [67-64-1]	N	N			I	Oral Only	13	100	13	100	26	9	2400	mg/m3
Acetonitrile [75-05-8]	Y	Y	6.00E+01	24-hr	D	6.00E-02							70	mg/m3
Acrolein [107-02-8]	Y	Y	3.50E-01	24-hr	I	2.00E-05			0.00004	300	0.003	100	0.25	mg/m3
Acrylonitrile [107-13-1]	Y	Y	3.40E-03	year	6.80E-05	2.00E-03					0.1	10	2	ppm
alpha-Pinene [80-56-8]	N	N												
Benzene [71-43-2]	Y	Y	1.30E-01	year	2.20E-06 | 7.80E-06	3.00E-02	0.009	10	0.006	300	0.003	300	10	ppm
Benzyl Chloride [100-44-7]	Y	Y	2.00E-02	year	B2 - Oral Only								5	mg/m3
Bromodichloromethane [75-27-4]	N	Y	2.70E-02	year	B2 - Oral Only	Oral Only	Oral Only				Oral Only			
Bromoform [75-25-2]	Y	Y	9.10E-01	year	1.10E-06	Oral Only	Oral Only		Oral Only		Oral Only		5	mg/m3
Bromomethane [74-83-9]	Y	Y	5.00E+00	24-hr	D	5.00E-03	0.001	90	0.02	90			80	mg/m3 (C)
Carbon Disulfide [75-15-0]	Y	Y	8.00E+02	24-hr	N	7.00E-01	0.3	30					20	ppm
Carbon Tetrachloride [56-23-5]	Y	Y	1.70E-01	year	6.00E-06	1.00E-01	0.03	30	0.03	30			10	ppm
Chlorobenzene [108-90-7]	Y	Y	1.00E+03	24-hr	D	Oral Only			Oral Only				350	mg/m3

			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[2] 1/(ug/m3)**	**RfC (mg/m3)**	mRL (ppm)	Factor	mRL (ppm)	Factor	mRL (ppm)	Factor	8-hr REL	Unit[3]
Chloroethane [75-00-3]	Y	Y	3.00E+04	24-hr	N	1.00E+01					15	100	2600	mg/m3
Chloroform [67-66-3]	Y	Y	4.30E-02	year	2.30E-05	Oral Only	0.02	100	0.05	300	0.1	30	240	mg/m3 (C)
Chloromethane [74-87-3]	Y	Y	9.00E+01	24-hr	D	9.00E-02	0.05	1000	0.2	300	0.5	100	100	ppm
cis-1,2-Dichloroethene [156-59-2]	N	N			I	Oral Only			0.3	100	1	100	790	mg/m3
cis-1,3-Dichloropropene [10061-01-5]	Y	N			4.00E-06	2.00E-02	0.007	30	0.008	30				
Cumene [98-82-8]	Y	Y	4.00E+02	24-hr	D	4.00E-01							245	mg/m3
Cyclohexane [110-82-7]	N	Y	6.00E+03	24-hr	I	6.00E+00							1050	mg/m3
Dibromochloromethane [124-48-1]	N	N			C - Oral Only	Oral Only	Oral Only				Oral Only			
Dichlorodifluoromethane [75-71-8]	N	N			N	Oral Only							4950	mg/m3
d-Limonene [5989-27-5]	N	N			N	N								
Ethanol [64-17-5]	N	N											1900	mg/m3
Ethyl Acetate [141-78-6]	N	N			N	Oral Only							1400	mg/m3
Ethylbenzene [100-41-4]	Y	Y	4.00E-01	year	D	1.00E+00	0.06	300	2	30	5	30	435	mg/m3
Hexachlorobutadiene [87-68-3]	Y	Y	4.50E-02	year	2.20E-05	N			Oral Only		Oral Only			
m,p-Xylenes [179601-23-1]	Y	Y	2.20E+02	24-hr	I	1.00E-01	0.05	300	0.6	90	2	30	435	mg/m3
Methyl Methacrylate [80-62-6]	Y	Y	7.00E+02	24-hr	E	7.00E-01								
Methyl tert-Butyl Ether [1634-04-4]	Y	Y	3.80E+00	year	N	3.00E+00	0.7	100	0.7	100	2	100		
Methylene Chloride [75-09-2]	Y	Y	6.00E+01	year	1.00E-08	6.00E-01	0.3	30	0.3	90	0.6	100	12.5	ppm
Naphthalene [91-20-3]	Y	Y	2.90E-02	year	3.40E-05	3.00E-03	0.0007	300					50	mg/m3
n-Butyl Acetate [123-86-4]	N	N											710	mg/m3
n-Heptane [142-82-5]	N	N			D	N							2000	mg/m3

			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[2] 1/(ug/m3)**		**RfC (mg/m3)**	MRL (ppm)	Factor	MRL (ppm)	Factor	MRL (ppm)	Factor	8-hr REL	Unit[3]
n-Hexane [110-54-3]	Y	Y	7.00E+02	24-hr	I		7.00E-01	0.6	100					1800	mg/m3
n-Nonane [111-84-2]	N	N													
n-Octane [111-65-9]	N	N												2350	mg/m3
n-Propylbenzene [103-65-1]	N	N													
o-Xylene [95-47-6]	Y	Y	2.20E+02	24-hr	I		1.00E-01	0.05	300	0.6	90	2	30	435	mg/m3
Propene [115-07-1]	N	Y	3.00E+03	24-hr											
Styrene [100-42-5]	Y	Y	8.70E+02	24-hr	N		1.00E+00	0.2	30			5	10	100	ppm
Tetrachloroethene [127-18-4]	N	Y	1.60E-01	year	2.60E-07		4.00E-02	0.006	300	0.006	300	0.006	300	100	ppm
Tetrahydrofuran [109-99-9]	N	Y	2.00E+03	24-hr	N, Suggested Evidence		2.00E+00							590	mg/m3
Toluene [108-88-3]	Y	Y	5.00E+03	24-hr	I		5.00E+00	1	10			2	9	200	ppm
trans-1,2-Dichloroethene [156-60-5]	N	Y	8.10E+02	24-hr	I		Oral Only			0.2	1000	0.2	1000	790	mg/m3
trans-1,3-Dichloropropene [10061-02-6]	Y	N			4.00E-06		2.00E-02	0.007	30	0.008	30				
Trichloroethene [79-01-6]	N	Y	2.10E-01	year	4.10E-06		2.00E-03	0.0004	10	0.0004	10			100	ppm
Trichlorofluoromethane [75-69-4]	N	N			N		Oral Only							5600	mg/m3
Trichlorotrifluoroethane [76-13-1]	N	N			N		Oral Only							7600	mg/m3
Vinyl Acetate [108-05-4]	Y	Y	2.00E+02	24-hr	N		2.00E-01			0.01	100				
Vinyl Chloride [75-01-4]	Y	Y	1.10E-01	year	4.40E-06	8.80E-06	1.00E-01			0.03	30	0.5	30		

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 - a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions. This is the random component of error. Precision is estimated by various statistical techniques using some derivation of the standard deviation. For this project, precision will be determined using collocated samples and laboratory duplicates to ensure sampling procedures and laboratory procedures are precise.

Bias - the systematic or persistent distortion of a measurement process which causes error in one direction. Bias will be determined by estimating the positive and negative deviation from the true value as a percentage of the true value. For this project, Field Blanks and Method Blanks will be used to determine if there are biases from the sampling procedures and laboratory procedures.

Representativeness - a measure of the degree which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. For this project, the first question is "what is coming from the refineries?" We can best determine influences from the refinery by selecting a near-source site (SAQMS1) and utilizing forecasting to select times to sample based on wind direction and atmospheric stability. Setting the forecast date to every 6-days ensures that our population is representative of all days there may be emissions – not just weekdays. Ensuring that the sample is 24 hours ensures capture of a full day-to-night cycle. Samples are taken at least 2 m from the ground every time would ensure the population is not influenced by dry deposition; thus, more accurately reflecting near-source concentrations.

Detection Limits - The determination of the low range critical value of a characteristic that a method specific procedure can reliably discern (40 CFR Part 136, Appendix B). The Detection Limits are determined by ALS based on EPA Method TO-15.

Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR Pt. 50). Completeness for this project will

Comparability - a measure of confidence with which one data set can be compared to another.

Accuracy - has been a term frequently used to represent closeness to "truth" and includes a combination of precision and bias error components. If possible, the District will attempt to distinguish measurement uncertainties into precision and bias components.

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

The MQOs for taking time-integrated samples of ambient air and performing TO-15 analysis are listed in Table 7-2. Detection and Reporting limits (Otherwise noted as Method Detection Limits (MDLs) or Method Reporting Limits (MRLs)) are determined by ALS according to the SOP "Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantification" (Element 26). The most recently determined MDLs for each analyte are listed in Table 7-4.

Table 7-2: MQOs Requirements and Acceptance Criteria

MQO Parameter	Requirement	Acceptance Criteria
Precision	Collocated samples taken simultaneously through 2 separate collection systems at the same location; once per quarter Laboratory Duplicates done by analyzing an additional portion of the sample using the same laboratory method.	All analytes < 15% CV or CV from MRL <15% if one sample/duplicate reports detecting an analyte and the other(s) doesn't.
Bias	Field Blanks taken twice per year; includes Shut-in test CFC-11 and CFC-12 comparison to NOAA Sampling in Colorado	All analytes < MRL (reported as "ND") or %CV from MRL <15% < 20% Difference in Monthly Averages
Completeness	Valid samples collected compared to samples planned.	>85%
Sensitivity	Determined by ALS as outlined in SOPs; "At least every thirteen months, re-calculate MDLs from the collected spiked samples and method blank results"	< 0.5ppbV for each analyte
Comparability	NATTs VOC sampling using TO-15 when possible	Sample date/time the same as NATTs
Representativeness	Neighborhood and Near-Source; see Section 10 for siting.	1 m from ground and 1 m from other surfaces/obstructions.

Table 7-3: NATTs MQOs Requirements and Acceptance Criteria for VOCs

MQO Parameter	Requirement	Acceptance Criteria
Precision	Duplicate samples or Collocated samples. Duplicate samples are taken simultaneously through the same collection system. Collocated samples are taken simultaneously through 2 separate collection systems at the same location. 10 % of total samples B 6 per year for 1-in-6 day sampling.	<15% CV
Bias	Performance Evaluation samples. 2 per calendar year.	+/- 25% for each analyte/sample
Completeness	Valid samples collected compared to samples planned.	>85%
Sensitivity	Experimentally determined MDL conducted per the specifications of 40 Code of Federal Regulations (CFR) Part 136, Appendix B. Determined annually, or after any major instrument change. Minimum of 7 low level canister standards analyzed over a 2-day period (minimum).	Benzene: 0.130 µg/m3 1,3-Butadine: 0.100 µg/m3 Acrolein: 0.100 µg/m3 Vinyl Chloride: 0.110 µg/m3 Trichloroethylene: 0.500 µg/m3 Tetrachloroethylene: 0.170 µg/m3 Chloroform: 0.500 µg/m3

Table 7-4: Measurement Detection Levels in µg/m³ Determined by ALS for TO-15 Analysis

Compound [CAS #]	MDL	Compound [CAS #]	MDL	Compound [CAS #]	MDL	Compound [CAS #]	MDL
1,1,1-Trichloroethane [71-55-6]	0.066	2-Hexanone [591-78-6]	0.066	Chloroform [67-66-3]	0.071	n-Heptane [142-82-5]	0.085
1,1,2,2-Tetrachloroethane [79-34-5]	0.074	2-Propanol [67-63-0]	0.22	Chloromethane [74-87-3]	0.086	n-Hexane [110-54-3]	0.11
1,1,2-Trichloroethane [79-00-5]	0.054	3-Chloro-1-propene [107-05-1]	0.072	cis-1,2-Dichloroethene [156-59-2]	0.075	n-Nonane [111-84-2]	0.089
1,1-Dichloroethane [75-34-3]	0.078	4-Ethyltoluene [622-96-8]	0.085	cis-1,3-Dichloropropene [10061-01-5]	0.083	n-Octane [111-65-9]	0.12
1,1-Dichloroethene [75-35-4]	0.074	4-Methyl-2-pentanone [108-10-1]	0.073	Cumene [98-82-8]	0.077	n-Propylbenzene [103-65-1]	0.077
1,2,4-Trichlorobenzene [120-82-1]	0.13	Acetone [67-64-1]	1.2	Cyclohexane [110-82-7]	0.15	o-Xylene [95-47-6]	0.077
1,2,4-Trimethylbenzene [95-63-6]	0.074	Acetonitrile [75-05-8]	0.13	Dibromochloromethane [124-48-1]	0.070	Propene [115-07-1]	0.13
1,2-Dibromo-3-chloropropane [96-12-8]	0.10	Acrolein [107-02-8]	0.15	Dichlorodifluoromethane [75-71-8]	0.087	Styrene [100-42-5]	0.086
1,2-Dibromoethane [106-93-4]	0.062	Acrylonitrile [107-13-1]	0.11	d-Limonene [5989-27-5]	0.11	Tetrachloroethene [127-18-4]	0.069
1,2-Dichloro-1,1,2,2-tetrafluoroethane [76-14-2]	0.084	alpha-Pinene [80-56-8]	0.082	Ethanol [64-17-5]	0.37	Tetrahydrofuran [109-99-9]	0.067
1,2-Dichlorobenzene [95-50-1]	0.079	Benzene [71-43-2]	0.077	Ethyl Acetate [141-78-6]	0.28	Toluene [108-88-3]	0.065
1,2-Dichloroethane [107-06-2]	0.059	Benzyl Chloride [100-44-7]	0.12	Ethylbenzene [100-41-4]	0.075	trans-1,2-Dichloroethene [156-60-5]	0.074
1,2-Dichloropropane [78-87-5]	0.066	Bromodichloromethane [75-27-4]	0.077	Hexachlorobutadiene [87-68-3]	0.11	trans-1,3-Dichloropropene [10061-02-6]	0.11
1,3,5-Trimethylbenzene [108-67-8]	0.077	Bromoform [75-25-2]	0.11	m,p-Xylenes [179601-23-1]	0.14	Trichloroethene [79-01-6]	0.072
1,3-Butadiene [106-99-0]	0.088	Bromomethane [74-83-9]	0.074	Methyl Methacrylate [80-62-6]	0.19	Trichlorofluoromethane [75-69-4]	0.081
1,3-Dichlorobenzene [541-73-1]	0.080	Carbon Disulfide [75-15-0]	0.16	Methyl tert-Butyl Ether [1634-04-4]	0.063	Trichlorotrifluoroethane [76-13-1]	0.076
1,4-Dichlorobenzene [106-46-7]	0.082	Carbon Tetrachloride [56-23-5]	0.074	Methylene Chloride [75-09-2]	0.15	Vinyl Acetate [108-05-4]	1.2
1,4-Dioxane [123-91-1]	0.063	Chlorobenzene [108-90-7]	0.071	Naphthalene [91-20-3]	0.13	Vinyl Chloride [75-01-4]	0.057
2-Butanone [78-93-3]	0.11	Chloroethane [75-00-3]	0.066	n-Butyl Acetate [123-86-4]	0.073		

Table 7-5: Equations

In the following table, the subscripts "k" indicates the analyte while "N" indicates the number of samples (population) that is used to calculate the mean or standard deviation. Occasionally the MDL is substituted for a "ND" value when one sample in the population does not detect that specific analyte in order to determine the mean or standard deviation.

Criterion	Equation
Mean: Calculate the Population Mean in order to calculated the %CV to assess Field Blank, Field Collocated Samples, and Laboratory Duplicates.	$\mu_k = \frac{\sum_{i=1}^{i=N} C_{i,k}}{N}$
Standard Deviation: Calculate the Population standard deviation in order to calculated the %CV to assess Field Blank, Field Collocated Samples, and Laboratory Duplicates.	$\sigma_k = \sqrt{\frac{\sum_{i=1}^{i=N}(C_{i,k} - \mu_k)^2}{N}}$
Field Blank: For each Analyte that is NOT below the MDL (i.e. not "ND") calculated the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) in the Field Blank and the Laboratory determined MDL ($C_{2,k}$). **Field Collocated Sample and Laboratory Duplicates:** 1. For each Analyte for which BOTH collocated samples or Laboratory duplicates are ABOVE the MDL, calculate the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) in the Sample and the Analyte concentration in the Field Duplicate or Laboratory Duplicate ($C_{2,k}$). 2. For each Analyte for which only ONE of the collocated samples or Laboratory duplicates are NOT below the MDL (i.e. not "ND") calculated the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) above the MDL in the Sample/Field Duplicate/Laboratory Duplicate and the Laboratory determined MDL ($C_{2,k}$).	$\%CV_k = \frac{\sigma_k}{\mu_k} \times 100\%$
Monthly Averages ($\mu_{m,k}$): For CFC-11 and CFC-12 Used for Performance Evaluation of CFC detection. (On this case "k" only indicates CFC-11 or CFC-12).	$\mu_{m,k} = \frac{\sum_{i=1}^{i=N_m} C_{i,k}}{N_m}$
Absolute Percent Difference ($\%D_k$): Calculate the percent difference between the calculate monthly mean of samples taken at one site location ($\mu_{m,k}$) and the monthly mean observed at NOAA's NWR site ($\mu_{NWR,k}$)	$\%D_k = \frac{\mu_{m,k} - \mu_{NWR,k}}{\mu_{NWR,k}}$
Percent Complete: Calculate the percent complete (%C) by finding the ratio of the number of samples taken that meet the MQOs (N_{MQO}) to the number of samples scheduled (N_{TOT}).	$\%C = \frac{N_{MQO}}{N_{TOT}}$

ELEMENT 8 - SPECIAL TRAINING/CERTIFICATION (A8)

8.1 - SITC

Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. 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.

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 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).

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.

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.

8.2 - ALS

ALS staff have their own training policy which is attached in the ALS SOP for “Training Policy” (Element 28).

ALS laboratory certifications are also listed in “ALS Accreditation in WA State” (Element 29)

ELEMENT 9 - DOCUMENTS AND RECORDS (A9)

It is critical that management understands that properly documenting the project's activities takes time. The air monitoring program is committed to fully documenting all activities relating to data collection, analysis, validation, and reporting. This is a substantial time commitment that must be factored into the responsibilities of the AQT, AQSp, and QADRs.

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 - File Locations

ALS provides only the necessary fraction of their documentation for QA/QC purposes. All records not provided to SITC are kept according to the ALS SOP for "Laboratory Ethics and Data Integrity" (Element 30).

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) request for access. Most, if not all, DEP files are kept under \\SITC2\Planning\USER\WATER\. In this part of the network, there are two important folders that contain relevant information:
    - \\SITC2\Planning\USER\WATER\0_ADMIN includes administrative and procurement information. Notated as "A:"
    - \\SITC2\Planning\USER\WATER\6_AIR_QUALITY\ includes all data and procedures for Air Quality monitoring. Notated as "N:"
    - Under "A:" or "N:" any subfolders have a LETTER or NUMBER added before the Folder title separated by an "_". This makes it easier to shorthand the file path. For example: N:\A\1\2\ = N:\A_AIR_PRG\1_AMBIENT_AQ_PROGRAM\2_HAPS\
- Another piece of the Swinomish Network is \\SITC2\Planning\USER\GRANTS which includes all Grant information under the assigned fund code. Notated as "G:". There is a shortcut to this folder under: A:\A\1\2\
- Microix Workflow Modules – Software that manages both Budgets and Requisitions. On SITC Network and liked with Abila (Accounting Software) managed by Swinomish Finance Department
- 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 31 for LabArchives SOP.
- Asana – Task Manager web-based application. Access through mobile application or website. Used by DEP; all tasks viewable by DEP employees.

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 location of electronic files are detailed in Tables 9-1 through 9-3.

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

Documents kept for Planning and Administrative reasons are listed below in The database in which all data is compiled is kept in a file named "TO-15_DATABASE.xlsx." The format of this document is attached for reference in Element 32.

Table 9-1. Documents kept for Routine Operations of Canister Collection are listed in Table 9-2. Documents including all Data Records are listed in Table 9-3.

The database in which all data is compiled is kept in a file named "TO-15_DATABASE.xlsx." The format of this document is attached for reference in Element 32.

Table 9-1: Planning and Administrative Records

Content	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Mission Statement	Description of Program Mission Statement	N:\C\2021_SP_AirQuality.pdf	AQSp	After Department Strategic Meetings
Grant	Draft and final copies of grant	G:\916-90-03-00\CY####-####\WORKPLAN	AQSp	When grant is renewed or modified
Position Descriptions	description of positions and management structure	N:\C\0\1\POSITION	AQSp	When program is established, whenever organization changes, new staff is hired
Budgeting	Budget Planning	G:\916-90-03-00\CY####-####\BUDGET	AQSp	Ongoing
Procurement	Invoices, Quotes, Receipts, Sale Orders, etc.	A:\A\1\3\916-90-03-00 EPA AIR PRG\ Files organized by line item. All procurement documents are also in Microix – a Financial Management software used to submit and track purchases · Desktop Access – AQSp · Web Access – AQT & AQSp · Approval – DDEP & ECM	AQSp & AQT	Ongoing
Training	Training records	N:\C\0\1\TRAINING_LOG.xlsx	AQSp	Information updated at least annually and as training is completed
Contracting	Copies of contracts with subcontractors, instrument vendors	Support contracts if applicable; filed by CONTRACTOR/VENDOR A:\A\1\4\	AQSp	When contracts are established, renewed, or changed
Planning - Objectives for Measurements	MQOs developed for Sampling Program	N:\A\1\2\QAPP\MQOs	AQSp	During planning, and revised as needed and at least every 3 years or whenever instrumentation, data management, siting, etc. changes.
Siting Information	Site maps and photos, rationale for siting at that location, restrictions if any, and type of site	Siting files are located in each station folder N:\A\A\1\SITING\SAQMS#	AQSp or AQT	Annually and if the analyzers are relocated
Planning - Site and QC Scheduling	Site schedule and assignment posted and assigned to AQT and AQSp	Yearly Sampling Schedule located in N:\A\1\2\ Tasks scheduled in AQ Outlook Calendar. Asana Tasks created and assigned – visible to all DEP employees	AQSp, AQT, and QA Reviewer	Updated as assignments change

Site Visit Documentation	Notes about each site visit, who was present, what was done, site/weather conditions	LabArchives elogbook available electronically to the QA Reviewer. All records made are subject to LabArchives SOP (Element 31)	AQSp and AQT	Updated every visit. Signed after returning to Office. PDFs of elogbook downloaded every quarter. New elogbooks created annually. Notebook LabArchive file and PDF saved to SITC2.

Table 9-2: Records for Routine Operations

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Initial readiness review - review of all the required data management operations and documentation	Email summarizing findings and/or informal report or memo	Memo/Email saved under N:/A/1/4/AUDITS/INTERNAL	QA Reviewer reviewed and filed by AQSp	Emails are saved upon receipt as PDF and outlook document; On project start or major revisions
Forecast Checklists	Review of Forecasts; documentation of decisions; location of images	Checklists: N:/A/1/2/A/FORECASTS	AQT or AQSp	When Scheduled; see N:/A/1/2/A/FORECASTS/YYYY_SAMPLING_PLAN
Calibration and recertification of standards	Calibration report, manufacturer certificates	Generate and Stored by ALS; As Contractor for Lab Service they are providing QA/QC data	PM at ALS	According to ALS SOPs
Assessments and Audits	reports from auditor	Generated and Stored by ALS; As Contractor for Lab Service they are providing QA/QC data	PM at ALS	According to ALS SOPs
Maintenance	General Maintenance Shut-In Tests; any action post-failure	Canister and GC-MS Maintenance done by ALS E-logbook with notes of any actions taken to modify collection assembly (i.e.Teflon tape, switching out flow controller) will be in LabArchives.	AQT and AQSp, reviewed by QA Reviewer	Every Sample
Shipping/Receiving of canisters and flow controllers	E-log for shipping/receiving	LabArchives Canister Chain of Custody spreadsheet in VOC sampling notebook	AQSp or AQT	As items come in or out
Calibrations of analyzers	Calibration data, summary reports	Generate and Stored by ALS; As Contractor for Lab Service they are providing QA/QC data	PM at ALS	According to ALS SOPs

Table 9-3: Data Records

Action/Event	Information Recorded (what)	Recorded in (where)	By Whom	How Often (when)
Data entry of ALS Results into TO-15 Database	All Meta Data and Results from ALS Entered into TO-15 Database	N:\A\1\4\TO-15_DATABASE.xlsx Sheets: METADATA, QAQC_ppb, QAQC_umg3	AQT initialed and dated	Within one week that the results from ALS are received
Field Blank Results; data entry of these QC results into the database	All Meta Data and Results from ALS for Field Blank Sample Entered into TO-15 Database	N:\A\1\4\TO-15_DATABASE.xlsx Sheets: METADATA, FB_umg3	AQT initialed and dated	Within one week that the results from ALS are received
Method Blanks, Lab Control Samples, and QC Spikes	Summary of Data Quality included in Meta Data based on Results from ALS for Method Blank and Lab Control Sample. Spike recovery percentages recorded.	N:\A\1\4\TO-15_DATABASE.xlsx Sheet: METADATA	AQT initialed and dated	Within one week that the results from ALS are received
Collocated Sample	All Meta Data and Results from ALS for Collocated Sample Entered into TO-15 Database	N:\A\1\4\TO-15_DATABASE.xlsx Sheets: METADATA, QC_ugm3	AQT initialed and dated	Within one week that the results from ALS are received
Lab Duplicate Sample	All Meta Data and Results from ALS for Lab Control Sample Entered into TO-15 Database	N:\A\1\4\TO-15_DATABASE.xlsx Sheets: METADATA, QC_ugm3	AQT initialed and dated	Within one week that the results from ALS are received
Internal QA Checklist	Check if values on 1 data entry per quarter entered into the database are consistent with 1 QAQC document from ALS	N:\A\1\4\AUDITS\INTERNAL Reported in email to ECM, AQSp, and AQT (we include this as a section in the quarterly Final Validation Report)	QA Reviewer reviews data entry as part of the quarterly data review	As directed by the ECM when the program is started or when there are changes in staffing, and at least quarterly after the program is established
Review of Collocation, Lab Duplicates, and FB QC checks, verifying that QC checks and maintenance are being conducted according to the QAPP	Check if QC mechanisms have been completed and recorded correctly; Notes about reasons for missing schedule, and keep these notes/email even when all is going according to schedule to prove this review is ongoing	N:\A\1\4\AUDITS\INTERNAL Reported in email to ECM, AQSp, and AQT (we include this as a section in the quarterly Final Validation Report)	QA Reviewer reviews data entry as part of the quarterly data review	As directed by the ECM when the program is started or when there are changes in staffing, and at least quarterly after the program is established
eLogbook (eLlog)	All information about data collection, shut-in test completion, date/time start/stop, errors, next steps, notes	LabArchives eLog is password protected, and pages are downloaded and saved in computer file quarterly N:\A\1\2\	AQT or AQSp	E-log pages downloaded and saved at least quarterly

Final data validation and health analysis	Upon Completion of QA & QC Checks, memo on findings, comparison to toxicology standards	Memo sent to DDEP and ECM saved in: N:\A\1\4\AUDITS\INTERNAL	AQSp	Before completing Reports to EPA or writing internal/external annual reports
Data housekeeping of electronic data files	Notes on any files moved, new folders created, etc.	N:\A\1\4\BACKUP_README_METADATA	AQT	When changes occur to the File Structure or Files are moved/renamed, etc.
Data Management--Reporting to Tribe	Interpretation of results, potential health impacts	Annual report to DEP	AQSp with help from AQT	Annually
Data Management--Reporting to EPA	As required by grant, summary of the QC checks and number of samples taken successfully. Any abnormal findings reported	Quarterly and annual report G:\916-90-03-00\CY####-####\REPORTS	AQSp taken from reports provided by the Site Operator, and QA Reviewer	Quarterly or Annually

9.2 - Data File Structure and Naming Conventions

This addresses data files only. Data files are solely electronic. All data files will be under the network path: N:\A_AIR_PRG\1_AMBIENT_AQ_PROGRAM\4_AQDB\ or short hand: N:\A\1\4\

Under "AQDB" Folder are the following FOLDERS that contain data relevant to this QAPP:

- AUDITS: Folder includes any and all audits – whether they are INTERNAL, EXTERNAL, or FEDERAL; for this project we only have INTERNAL audit documents as ALS has external and Federal Audits on their instrumentation in their file system.
    - Folders of type names (listed above) are under the AUDITS folder
    - File Name: YYYYMMDD_QAQC_CHECKLIST
        - YYYYMMDD = Internal Audit Date
- BACKUP: Folder is READ ONLY and will hold all ORIGINAL Data. No changes will be made.
    - **Historical** Data moved to this folder will have the old file path, name, and date created saved in "N:\A\1\4\BACKUP_README_METADATA.xlsx
        - If the files require editing (i.e. add headers, deal with gaps in data, data format to csv file, file name, etc.), the edited file will be added to the "RAW" or "QAQC" within the "4_AQDB" folder and the edits noted in this File.
        - See "README" Tab for more information
- QAQC: This includes a running database of all data that have gone through the QA/QC data checks
    - This data IS QA/QC'd
    - QAQC has two subfolders: FIELD and LABORATORY. ALL QAQC data for this QAPP is saved under LABORATORY as they are QC documents from ALS.
        - Data Naming Convention: "YYYYMMDD_LOC.pdf" where
            - YYYYMMDD are the Year, month and day (zeros included) of the first data entry in the file
            - LOC is the station (so SAQMS# where # is 1, 2, 3, 4, …..)
- RAW: This includes all files obtained directly from ALS that do not have any narrative about QAQC. This data is NOT QA/QC'd.
    - RAW has two subfolders: FIELD and LABORATORY. ALL RAW data for this QAPP is saved under LABORATORY as they are raw data documents from ALS.
        - Data Naming convention is:" YYYYMMDD_LOC.xlsx" where

- YYYYMMDD are the Year, month and day (zeros included) of the first data entry in the file
- LOC is the station (so SAQMS# where # is 1, 2, 3, 4, …..)

The following file in 4_AQDB is the location of the compilation of all Metadata, QC data, and sample data: TO-15_DATABASE.xlsx. Example is attached in Element 32.

9.3 - Terminology and Phases of Data Review

9.3.1 - *Terminology*

Our program uses the term "to flag," as synonymous with "to qualify" and signifies adding alphanumeric codes to additional fields in each row of data that has anything questionable or notable about it, but does not invalidate the actual data value. Adding flags during import or subsequent review helps make our final data validation more efficient, because we can more easily find and understand the reason for flagged records (e.g., a Time Flag of "L" indicates the sampling time was less than 23 hours).

9.3.2 - *Phases*

Our data review has 3 major phases. The 1st phase is completed by ALS. ALS complies a document and assigns Data Quality Flags based on their internal processes. The 2nd phase is completed by the AQT, who imports data into the TO-15 database within a fourteen (14) days of receiving the reports from ALS. When the data are imported into the database, the AQT enters flags that meet certain criteria. After the data import for the entire quarter is completed, the *final* data validation is scheduled for data review by the QA Reviewer.

1. The first phase of data review is that which is conducted by ALS. ALS tracks internally, compiles a document, and assigns Data Quality Flags (DQF) based on their internal processes. ALS then writes up a case narrative that addresses any and all Data Quality issues. This is done for every sample and sent to the AQSp and AQT upon completion of review with the raw data in an excel spreadsheet.

2. The second phase of data review occurs when the AQT imports data into the database. This includes metadata that corroborate a reason a record should be flagged, for example. The user-supplied input as well as all notes about flags are documented in the METADATA piece of the database:

- Duration of Sample - used to flag data; sample start date, start time, end date, and end time
- Dilution factor, Volume analyzed
- Spike Percent Recovery; Concentrations that are flagged by ALS due to Lab Control Sample or Method Blank issues.
- Laboratory Duplicate metadata if occurred

3. The *final* phase of data review is Final Data Validation (see Element 21 for more details), and consists of establishing and documenting the validity or invalidity of values in the QA/QC checklist by the QA Reviewer.

9.4 - Data Review Documentation Requirements

All of these data review steps are documented in a QA/QC checklist and/or in emails that are saved with the quarterly data review documentation.

A. As much independence of the "QA function" as possible is built into our small program, by using a QA Reviewer (see Element 4).

B. The person who enters the results of the QC checks into the database routinely verifies every value that was entered, either immediately after the information was typed into the database, or prior to the next QC check entry. This verification includes confirming that any "pass/fail" values were correct.

C. In addition, for the first three QC checks conducted on any equipment, 100% of any calculations done by the sheet (or judgments by the AQT or AQSp that results were within limits) are verified by the QA Reviewer. After the QA Reviewer has found no computational or other errors in three consecutive QC checks, at least one field per QC check is verified by the QA Reviewer. Before release of data to the public or EPA a QA/QC Checklist must be completed (Element 33). Any questions or discussion the QA Reviewer has about the data is documented in emails to the AQSp and the AQT, and is saved with the quarter's data package.

D. The data review process is standardized as much as possible, and thoroughly documented. This results in quarterly valid data packages that includes all supporting files such as eLogbook pages, ALS Results, copies of emails, and narratives explaining the reason for judgments about any Data Quality Flags.

E. The outcome of final data validation is a thorough report that contains enough information indicating which documents, reports, files, outside data, and QC sheets were reviewed to allow a qualified, outside person (e.g., an auditor) to reconstruct the logic and supporting information that justifies reasons for the judgments on data validity.

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.

10.1 - Sampling Locations

Our Air Monitoring Network consists of three (3) Swinomish Air Quality Monitoring Stations (SAQMS) at which we have at least a weather station that monitors: Temperature (2m), Relative Humidity (2m), Wind Speed (10m), Wind Direction (10m), Solar Radiation, and Precipitation. As of the writing of this QAPP, only SAQMS1 has CAPs monitoring (Ozone and NOx). SAQMS3 is in the process of being replaced by SAQMS5 as the siting specifications for Ozone are not in compliance with the CFR; location to be determined within the Swinomish Village Area.

For this project, we will collocate the HAPs collection with CAPs monitoring. This means only SAQMS1 will be used for HAPs collection. When the location for SAQMS5 is determined and both weather data and CAPs data are being collected, we will revise this QAPP to include SAQMS5 as a sample site and update sample scheduling and procedures to accord for this change.

SAQMS4 has only meteorological data. At this time, there is no reason to include SAQMS4 in locations for VOC sampling as it is not near-source or located where there are larger population density on Reservation. The Location of these sites in relationship to population density is shown in Figure 10-1

10.1.1 - *SAQMS1*

The first SAQMS is located at the northern end of the Reservation, to the NW of the Casino building and about 20 ft south of the rail way at the coordinates: 48.460244^{0}N, -122.520916^{0}E, 1 meter above sea level. This site is primarily for monitoring the emissions from the three Title V sources located at March point (roughly 2 miles to the west) – see Figure 10-2. SAQMS1 is thus situated to monitor near-source emissions on a neighborhood scale.

SAQMS1 is easily accessible; when not accessible (most likely due to snow storms) sample dates will be move back a day or two as we have wiggle room in our DQOs. This sample location may have interferences from 2-stroke motors and other construction equipment used to maintain the grounds around SAQMS1 by the Casino staff. Notes will be taken if it appears maintenance occurred in the area to flag data.

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

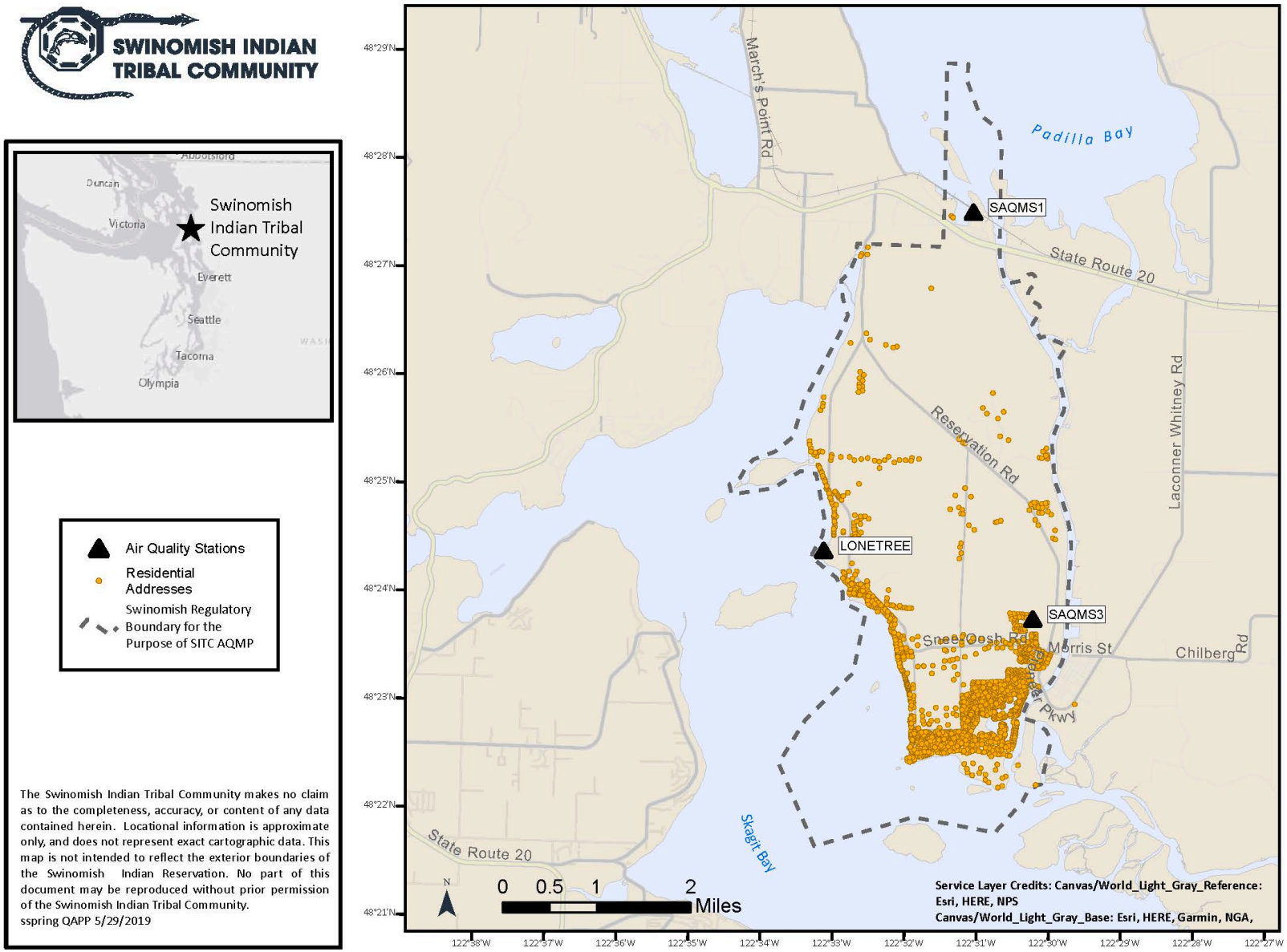


Figure 10-2: Satellite Image of SAQMS1; Marathon and Shell Refineries are indicated.

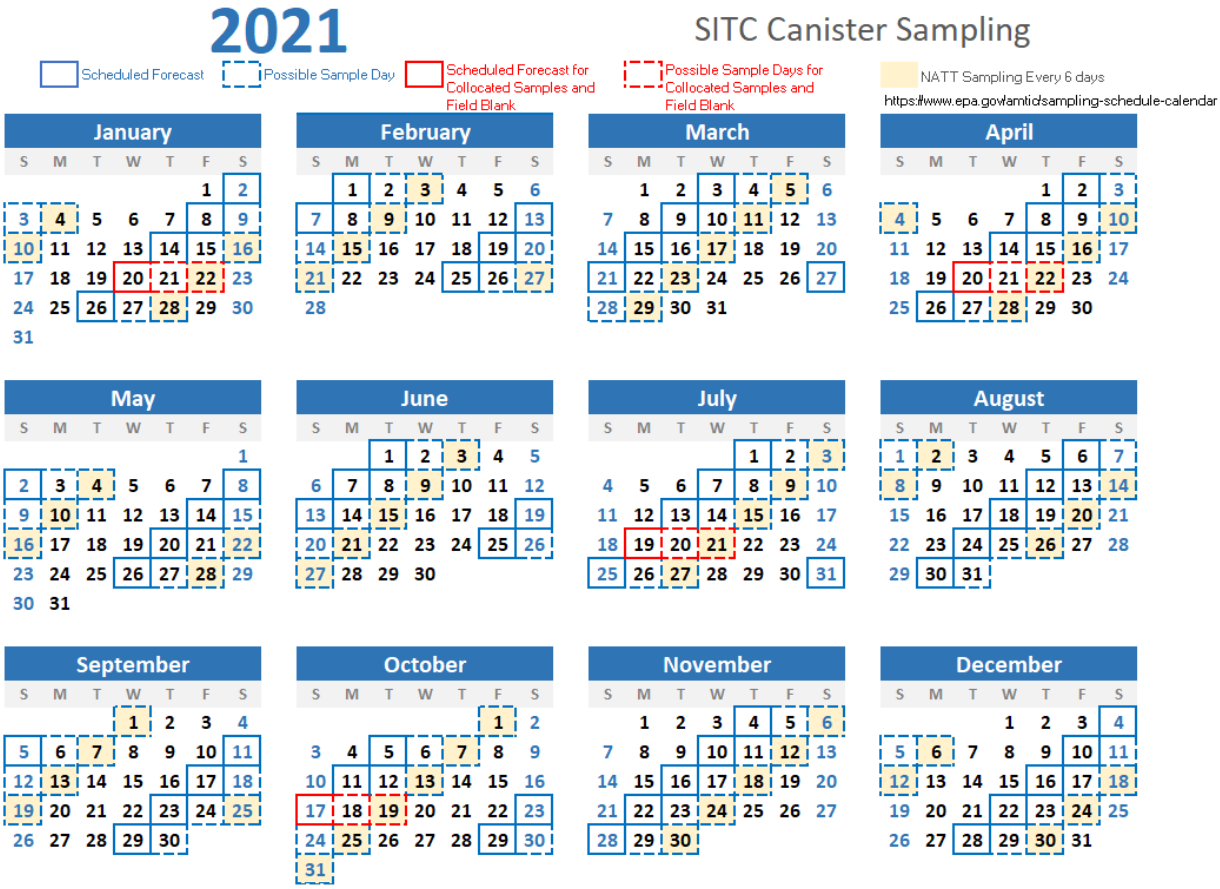
10.2 - Sample Scheduling

We had a couple of different possible ways of deciding when best to sample. We could sample at the same date/time as the NATTs samples occur which would establish a background; however, that wouldn't necessarily give us information on what is coming from the refinery. We could use forecasting to determine when conditions are favorable to sample air coming from the refinery; however, that would bias high any determination of background concentrations. Due to the most important questions from the community being: "What is coming from the refinery?" We have prioritized sampling refinery air. To do this, our sampling schedule is actually more of a forecast schedule. We have a set date to look at forecasts produced by NRMC and the sample will be taken within 72 hours of the forecast initialization at 5:00 am local time of the scheduled forecast day.

In order to give us some flexibility to sample at the same time as the NATTs, the forecast is scheduled to occur 43 hours before the NATTs samples are taken to allow us to determine if we want to sample at the same time as the NATTs. As we do not have the equipment to automate sampling from midnight to midnight, this is not a requirement yet, but we will have the goal to sample at the same time as the NATTs at least once a quarter.

A schedule will be created using the Template attached in Element 34. An example of what this schedule looks like for 2021 is shown below in Figure 10-3.

Figure 10-3: Example Sampling Schedule for 2021



Other Project activities, due dates, and other information about scheduling are listed below in Table 10-1.

Table 10-1: Schedule of Project Activities

Activity	Due Date	Comments
Ordering Schedule Determined	1 Month before next Year	Communicated to ALS through Hayden for reoccurring orders
Receive canisters and flow controllers	Once weekly	
Begin routine sampling	7/1/2021	
Collocated Sample	Once per quarter	
Field Blanks	Twice per Year	At same time as Collocated samples
Laboratory Duplicates	ALS determined	Depends on the concentrations measured; ALS rotates between clients that have detectable compounds for Laboratory Duplicates
Internal Audit pre-Final Data Validation	Quarterly, before 30 days of previous quarter ended.	Completion of QC Checklist Complete Performance Evaluation
Review internal and external QA reports	Ongoing	Needed to determine which, if any, monitors fail QC limits.
Primary site review	Annually	
Evaluate location of monitors	Annually	At time of site review.

ELEMENT 11 - SAMPLING METHODS (B2)

11.1 - Purpose/Background

The Sampling Methods used by SITC AQ Program are detailed in the below referenced SOPs:

1. Canister Collection (Element 35)
    a. Forecast Checklist (Element 36)
    b. ALS Canister Sampling Instructions (37)
2. LabArchives (Element 31)

ALS SOPs that outline the preparation and decontamination of sampling equipment are:

1. "Cleaning and Certification of SUMMA Canisters and Other Specially Prepared Canisters" (Element 38)
2. "Flow Controllers and Critical Orifices" (Element 39)

11.2 - Sampling Equipment, Preservation, and Holding Time Requirements

11.2.1 - *Sampling Equipment*

ALS supplies the following equipment to the SITC AQ Program:

1. Flow Controllers (both types are supplied):
    - Restek Passive Air Sampling Kit (Veriflow SC423XL Flow Controller)
    - Entech CS1200E Passive Canister Sampler

    ***NOTE: The Restek and Entech models use a replaceable restrictor orifice that determines the flow range of the controller. Critical Orifices are Laboratory manufactured see aforementioned SOP for more information.

2. Gas Collection Devices
    - Lab Commerce, Aerosphere Model S6L, 6.0L Passivated Canisters or equivalent

11.2.2 - *Sample Contamination Prevention*

No lubricants, penetrating oil, or other chemical compounds can be used to open the canisters.

11.2.3 - *Temperature Preservation Requirements*

Canisters received from ALS will be stored in a stable temperature environment between 15-30ºC. Canisters post-sampling will be dropped off to FedEx drop-off locations that store packages indoors.

11.3 - Sample Preparation

The preparation of SUMMA Canisters used to take the 6L ambient air sample for analysis is performed by ALS. The SUMMA canisters are cleaned according to the cleaning procedures outline in ALS' SOP "Cleaning and Certification of SUMMA Canisters and Other Specially Prepared Canisters" in Element 38. The preparation of Flow Controllers (FC) are described outline in ALS' SOP "Flow Controllers and Critical Orifices" in Element 39. A brief summary of the equipment and procedure for cleaning the Canisters and Flow Controllers is as follows:

11.3.1 - *Canister Cleaning Equipment*

The canister cleaning system is comprised of:

1. Cleaning manifolds
    a. Some of the cleaning manifolds are also attached to an oven manifold used to clean higher concentration canisters
    b. Each manifold has its own pump and pressure gauge; may share a common gas source
2. Nitrogen source with humidifiers
    a. Auxiliary vapor outlet on a Liquid Nitrogen Tank supplies the gas
    b. Nitrogen gas is piped (copper/stainless steel/PFA Teflon) to a hydrocarbon trap
    c. Pressure reduced from 50-80 psig to 10-15 psig before being humidified
    d. Humidifier, fittings, and regulator are all 304 or 316 stainless steel
3. High vacuum pumps
    a. There are two different vacuum systems
        i. Dual-stage direct driven rotary-vane type capable of reaching <10 mTorr
        ii. Two-stage oil-less pumping system comprised of a molecular drag pump backed by a diaphragm-type roughing pump capable of reaching <500 mTorr
4. Digital vacuum/pressure gauges (in millitorr)
    a. Range on Manifold Pressure Gauges: 0-2000 mTorr
    b. Range on Pressure/Vacuum Gauge: -14.7 – 100 psig
5. Electric ovens and Heating Bands
    a. Heats Canister up to 100 °C
6. Electronic control units
    a. The canister cleaning manifolds are controlled through a remote I/O board and a custom designed PC-based software program

11.3.2 - *Canister Cleaning Method*

The following is an outline of the Cleaning Method of SUMMA Canisters. See Section 11 of Element 38 for more information.

1. Canister Tracking:
    a. Barcode is scanned into ALS's Laboratory Information Management System (LIMS).
    b. If barcode is too degraded, replace barcode. MUST have two people to enter manually.
2. Pre-purging:
    a. All canisters containing samples with elevated contaminant levels are evacuated and purged before cleaning.
        i. Exceptions:
            1. Will be made for canisters that are returned but unused
            2. May be made for canisters with very low analyte concentrations (<5000 ng/L)

3. Cleaning Cycles:
    a. The number of cleaning cycles needed to sufficiently clean a canister is dependent on the concentration of the sample previously in the canister
        i. Exact number is not significant as canisters must pass a final QC check
        ii. Typically, canisters are cleaned with 20 cycles (as that is how many cycles fit in an overnight cleaning session)
        iii. Shorter cleaning (minimum of 5 cycles) can be used on low level canisters
    b. Evacuation and Fill Set Points
        i. 20 minutes for evacuation
        ii. 10 minutes for fill
        iii. Some manifolds use pressure setpoints:
            1. Filled to -5 to 0 psig
            2. Evacuated to < 500 mTorr

11.3.3 - *Flow Controller Cleaning Equipment*

The following is a summary of the equipment outlined in ALS's Element 39 utilized for cleaning and certifying Flow Controllers:

1. Cleaning Manifold:
    a. Made of 316 Stainless steel tubing and fittings
    b. Attached to the manifold so that flow will pass through in the opposite direction of sampling
2. Gas Source:
    a. Nitrogen or "breathing quality air"
    b. Regulated flow down to 5 mL/min for each manifold
    c. Isolated from the manifold
    d. Made of 316 Stainless steel tubing (of Teflon) and fittings
3. Electric Oven:
    a. Set to 60°C ± 5°C
    b. Maintained by electronic thermostat or power controller
4. Vacuum Source:
    a. Canister or Pump fitted with 316 Stainless steel Tee
    b. On one arm of Tee, a vacuum gauge (analog or digital) that reads down to -30"Hg
    c. Remaining arm leads to Flow Controller
    d. If Canister used; must be re-evacuated if internal reaches -20"Hg
5. Digital Flow Meter:
    a. There are several suitable types of flow meters that provide acceptable accuracy and repeatability, including electronic mass flow and volumetric meters.
    b. The flow rate of the flow controller must fall in the working range of the flow meter
        i. The working range of the sampling devices used by the laboratory is 0.5mL/min to 1250mL/min

11.3.4 - *Flow Controller Cleaning Method*

The following is a summary of the procedures outlined in Element 39 for the cleaning of Flow Controllers:

1. A manual batch processing system is used to clean flow controllers, where they are placed in an oven at approximately 60°C on a cleaning manifold and purged with high quality air for 2-3 hours.
    a. Once in the oven with the flow started from the source, measure the flow through each Flow on the cleaning manifold using an electronic flowmeter
    b. Adjust the regulator or needle valve on the nitrogen tank to get approximately 10ml/min.
    c. The flow will vary in each Flow Controller; flow should be at least 2ml/min flow the cleaning process to be successful
    d. Place Cleaned Flow Controllers in appropriately labeled area

11.4 - Passive Time-integrated Sample Collection

A fully detailed SOP developed by the SITC AQ Program for the collection of samples is detailed in Element 35. The following is a summary of the Sample Collection procedures:

- Canister and Flow Controller is removed from packaging near sampling location
- Canister information is recorded on Chain of Custody
- e-Logbook page started; Canister and Flow Controller ID recorded
- Canister cap removed. Flow Controller attached to Canister
- Shut-in Test performed; Repeated until passed
- Canister placed at the designated sample location at the site; locked to immovable object
- Canister opened, note time and Flow Controller reading in e-Logbook with image
- Return after 24 hours; Measure Atmospheric Pressure
- Record pressure difference between the Canister and ambient air in e-Logbook (with image)
- Close Canister, remove flow controller, replace cap
- Place Canister and flow controller in shipping box
- Sample Custody log finished
- Place finished log in shipping box; take to FedEx Drop location; note time in e-Logbook

As COVID-19 is ongoing, the SITC "COVID-19 Physical/Social Distancing Policy and Shared Equipment Protocols" (Element 40) are in effect until SITC Senate determines the protocols are no longer necessary. COVID-19 will not impact sampling schedule.

11.5 - Sampling/Measurement System Corrective Action

The following table lists possible issues that would arise during sampling. If any issues arise that aren't listed below, the AQSp is the contact. The AQSp (possibly in conjunction with the ALS PM) will determine the path forward either with a possible correction or deciding to nullify that canister and return to ALS. Any deviations from the normal procedure will be documented in the e-logbook.

Issue	Contact	Correction	Document
Canister Cap is vacuumed tight to Canister and will not easily be removed	EMC or DDEP AQSp will decide	Request help from Other DEP staff on Reseravtion; may need to use other Canister for this If unable to open: Use as Field Blank OR Return and Ask for Replacement canister; use other canister on hand.	Document decision, document new Canister and Flow Controller if replaced. Note in LabArchives, AQSp will send email to ALS PM
Canister Valve will not turn	Caanan, Joe, or Dennis AQSp will decide	Request help from Other DEP staff on Reseravtion If unable to open: Use as Field Blank OR Return and Ask for Replacement canister; use other canister on hand.	Document decision, document new Canister and Flow Controller if replaced. Note in LabArchives, Change Canister and Flow Controller number. AQSp will send email to ALS PM
Shut-in Test Failed	AQSp	Retry after adjusting/tightening canister/flow contoller and cap. If fail multiple times (>=3) have second staff member attempt If fail again, use teflon tape on junctures. Retry Test. If fail again, Flow Controller may have a leak. Use Flow Controller from other canister. And repeat Test with new Flow Controller.	Document in eLogbook, document new Flow Controller if replaced. AQSp will send email to ALS PM with problem
Accidental Canister Open	AQSp	Return Canister; use other canister on hand.	Document accident, document new Canister and Flow Controller used. AQSp will send email to ALS PM with nullification and request for additional Canister
Post-Sampling Error*	Hayden, AQSp	Determined in conversation with Hayden; may decide to not analyze sample and request replacement.	Flagged in LabArchives; will be included in final analysis report and saved on Intake form

*This could include: valve not closed during shipment, cap loose, sample pressure low (flow controller out of specifications on calibration check)

ELEMENT 12 - SAMPLE HANDLING (B3)

12.1 - Purpose/Background

The 6L SUMMA Canisters are transported from the Simi Valley Lab to the Swinomish Reservation through FedEx. Canisters are packaged with paper padding to reduce movement. Flow Controllers are further secured within a smaller box with either foam or bubble wrap packaging.

The package containing the sample canister and flow controller will be shipped to a secure location where packages are stored inside at a stable temperature. These secure locations are either: 1) Government building on Reservation that is accessible to staff or 2) Staff member's household.

12.1.1 - *Permissible Holding Times*

Canisters cannot be held for more than 30 days from receiving date. Date received, Sample Date, and Date returned and the location of the sampler for each Canister and Flow Controller are recorded in our Sample Inventory Log. An excerpt of this log is shown below in Table 12-1. The tracking of "Date In" allows the program to ensure that the first canister that will be used for collection (if there are two in custody) is the canister with the earliest "Date In."

Table 12-1: Sample Inventory Log Excerpt

ID #	Date In	Sample Date	Date Out	Tracking #	Notes
AS01342	2/12/2020	2/13/2020	2/14/2020	102833947539	In Kelsey's possession from 2/13/2020 at 6:00pm until relinquishment to Bellingham Walgreen's at 12:35pm on 2/14/2020.
FCR00450	2/12/2020	GS	2/14/2020	102833947539	In Kelsey's possession from 2/13/2020 at 6:00pm until relinquishment to Bellingham Walgreen's at 12:35pm on 2/14/2020.
AS01284	3/3/2020	3/4/2020	3/5/2020	10233945282	Delivered to Admin Building. Relinquished to Tillinghast Postal at 5:38pm 3/5/2020.
AS01298	3/3/2020	3/4/2020	3/5/2020	10233945282	Delivered to Admin Building. Relinquished to Tillinghast Postal at 5:38pm 3/5/2020.

12.2 - Sample ID Tracking

One of the most important values in the sample custody procedure is the unique sample ID number. In our sampling program, this is a set of four numbers: Client Sample ID, Laboratory ID Number, Canister ID, and Flow Controller ID.

- The Client Sample ID is assigned by SITC Air Program and based on the following formula:
    - [LOCATION][MM][DD][YY].
        - Most likely, LOCATION will be "SAQMS#" for "Swinomish Air Quality Monitoring Station #".

    - If other locations are used - to get representative source samples - these locations will be documented with a picture and latitude/longitude.
    - In the case of a travel blank, the LOCATION will be "TB."
- The Laboratory ID Number is for multiple collocated samples; this is usually "1."
- The Canister ID is assigned by ALS for:
    - ALS tracking of QA/QC procedures and sample prep
    - ensuring the sample can be tracked throughout the storage and analysis process
- The Flow Controller ID is also assigned by ALS for:
    - ALS tracking of QA/QC and traceability to NIST standards

The location of the Canister ID and Flow Controller ID are shown below in Figure 12-1 and Figure 12-2.

Figure 12-1 (Left) Canister Label assigned by ALS; found on top of the canister with barcode. Usually, "AS#####" or "AC#####"

Figure 12-2 (Right) Flow Controller Label assigned by ALS; found on the side of the pressure gauge with barcode. Usually "FCR#####"

12.2.1 - *Pre-Sampling Custody*

ALS provides SOPs on how the SUMMA canisters will be conditioned and stored (see sections 7 (storage) and 11 (conditioned) as well as how the Flow Controllers are verified against NIST standards (Appendix (Y) section 8)).
When packaged for shipment, a blank *Chain of Custody Record and Analysis Service Request* form is included with instructions, the Flow Controller, and the Canister. The package containing the evacuated canister will be kept in a shelter with regulated temperature until use. This will be notated in an electronic Excel log kept in the LabArchives Notebook:

The AQT will perform the following Sample Planning activities:

1. Check the forecasted stability (WRF Skew-T found on: https://a.atmos.washington.edu/wrfrt/rt/soundings_d3.cgi?GFS+timeindep)
2. Check the forecasted trajectories (WRF 4-km trajectory https://a.atmos.washington.edu/wrfrt/data/timeindep/gfsinit.aq.html#4km)
    a. Forward trajectories: Anacortes Refineries at 50 m

3. Determine sampling priority with AQSp based on forecasts. The general priorities are as follows:
    Priority 1) Emergency Grab Sample due to refinery release
    Priority 2) Capture air that may be influenced by refinery emissions
    Priority 3) Capture residential wood burning emissions during inversion events
    Priority 4) Compare to NATA by sampling on the same day/time, collocated
    Priority 5) Travel Blank required once/quarter
4. The process has been standardized by completing a "Forecast Checklist" and all forecasted Skew-Ts and forward trajectories images will be recorded.

The AQT will perform the following pre-sampling activities:

1. Retrieve (if stored at a separate location)
2. Put on appropriate laboratory attire.

Upon arrival at a site:

1. Remove Canister and Flow Controller from box. In LabArchives, record Canister and Flow Controller ID.
2. On the *Chain of Custody Record and Analysis Service Request,* fill in the **teal** boxed areas on Figure 12-3.
3. Attach Flow Controller to Canister if taking a time-integrated sample
4. Complete a Shut-in Test; if pass continue, if not adjust and repeat till pass or replace Flow Controller
5. Lock Canister to immovable object
6. Take Sample by opening the Canister valve and take image of Canister with Flow Controller pressure gauge reading visible
7. Once the sample is installed at the site, on the *Chain of Custody Record and Analysis Service Request* complete the **light blue** boxed areas on Figure 12-3.

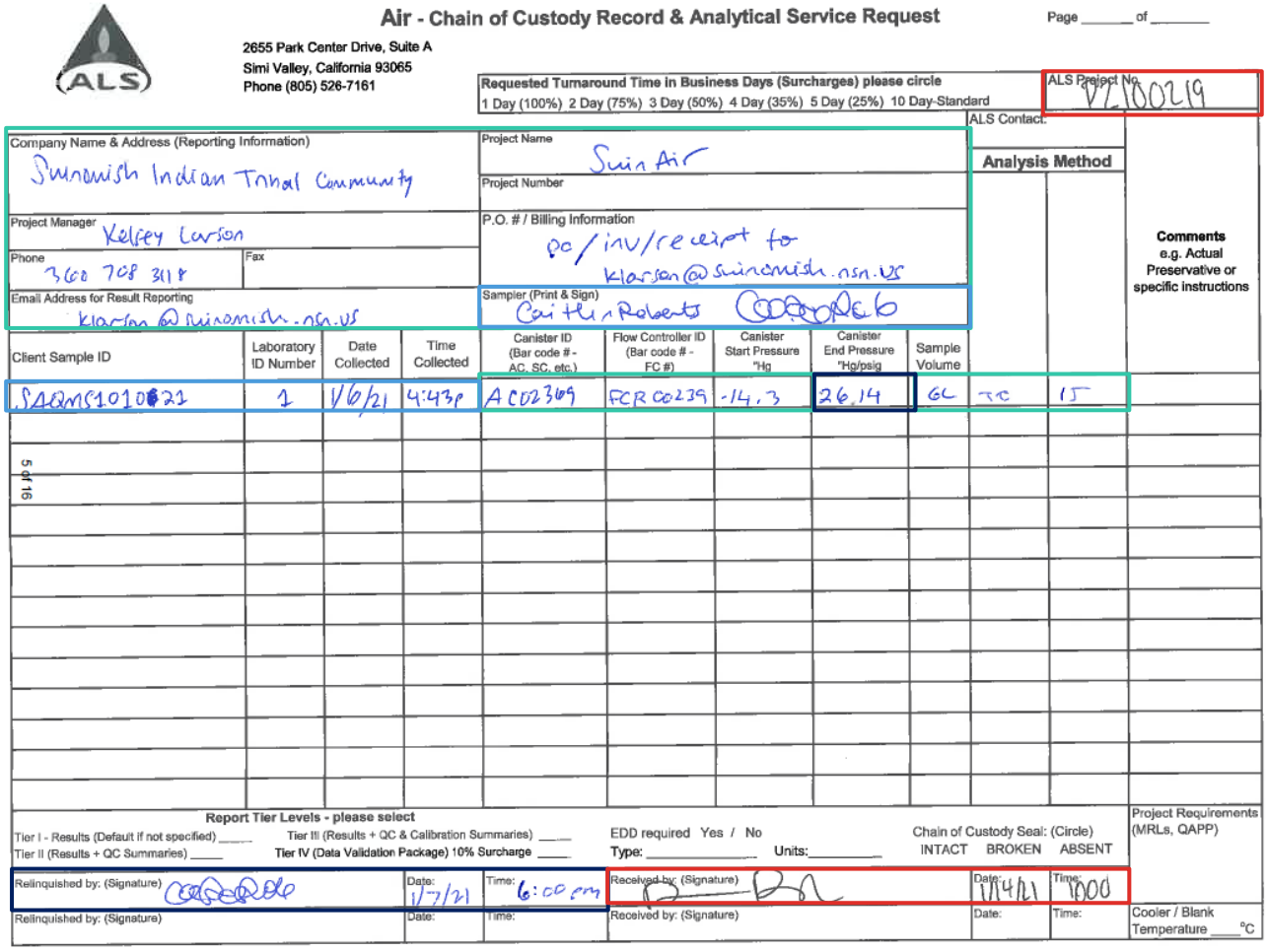
12.2.2 - *Post Sampling Custody*

The SITC SOP for Canister Sampling (Element 35) specifies the techniques for properly collecting and handling the sample.

Upon visiting the site:

1. Stop sample collection and document as described in SOP.
2. On the *Chain of Custody Record and Analysis Service Request*, complete the **dark blue** boxed areas of Figure 12-3.
3. Repackage Canister and Flow Controller. Place top copy of the *Chain of Custody Record and Analysis Service Request* (white copy) in shipping box and seal with tape.
4. Yellow carbon copy stored in top drawer of the wide file cabinet in the office space at SAQMS1.
5. Take Sample to FedEx pick-up that is temperature controlled (i.e. indoor storage). Document as described in SOP.

Figure 12-3: Filled out Chain of Custody Log Shipped with Canisters Post-Sampling to ALS. Colors indicate order of completion; Teal first pre-sample, Light blue after sample begins, Dark blue post- sampling, and Red upon ALS receipt of Sample.



Air - Chain of Custody Record & Analytical Service Request

Page _____ of _____

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

ALS Project No. R2100219

ALS Contact:

Company Name & Address (Reporting Information): Swinomish Indian Tribal Community

Project Name: Swin Air

Project Number:

Project Manager: Kelsey Larson

P.O. # / Billing Information: po / inv/receipt to klarson@swinomish.nsn.us

Phone: 360 708 3118 Fax:

Email Address for Result Reporting: klarson@swinomish.nsn.us

Sampler (Print & Sign): Caitlin Roberts

Analysis Method

Comments e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume			
SAQMS101021	1	1/6/21	4:43p	AC02369	FCR00239	-14.3	26.14	6L	TO	15	

5 of 19

Report Tier Levels - please select
Tier I - Results (Default if not specified) _____ Tier III (Results + QC & Calibration Summaries) _____
Tier II (Results + QC Summaries) _____ Tier IV (Data Validation Package) 10% Surcharge _____

EDD required Yes / No
Type: _____ Units: _____

Chain of Custody Seal: (Circle)
INTACT BROKEN ABSENT

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
	1/7/21	6:00 pm		1/14/21	1000
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ____°C

12.2.3 - *Sample Receipt*

The samples arrive at ALS, where staff will follow the ALS "Laboratory Storage, Analysis, and Tracking SOP" (Element 41). To briefly summarize, under the direction of the Project Manager at ALS Simi Valley (PM_{ALS}):

1. The Sample Management Office (SMO) will receive shipping/transport container(s).
2. Upon receipt, the SMO will open the container(s) to find *Chain of Custody Record and Analysis Service Request*. Assign Work Order number (top corner) and sign and date on the *Chain of Custody Record and Analysis Service Request*, complete the **red** boxed areas of Figure 12-3.
3. Fill out the *Sample Acceptance Check Form.* Check sample container seals, condition, Canister ID and Flow Controller ID match *Chain of Custody Record and Analysis Service Request,* and assign Laboratory ID number based on the Work Order number. Sample

information (the two aforementioned forms) is entered into the LIMS with storage location.

4. PM_{ALS} approves job file in LIMS and sends Project Manager at SITC (AQSp) the completed *Air Chain of Custody Record and Analysis Service Request.*
    a. In case of issues found during the Sample Acceptance Check Form (i.e. not sealed properly), PM_{ALS} will call AQSp to inquire about whether or not the sample should be analyzed.
5. Analysts review all LIMS documents and determine analyze date.
6. Analyst pressurize canisters (if need be) and store canister on the sample shelf with the appropriate label/sign for analysis, they are to remain there until they are to be analyzed.
7. During the analysis process, a record of all procedures to which a sample is subjected while in the possession of the laboratory are maintained and include original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms and other instrument response readout records), computer data files, analytical notebooks, and run logs.
8. A completed analysis file is sent to AQSp including:
    a. Laboratory Report
    b. Case Narrative
    c. Certifications, Accreditations, and Registrations
    d. Detail Summary Report
    e. *Air Chain of Custody Record and Analysis Service Request*
    f. *Sample Acceptance Check Form*
    g. Analysis Results for:
        i. The Sample
        ii. Method Blank
        iii. Lab Control Sample
    h. Invoice

Figure 12-4: Example Sample Acceptance Check Form completed by ALS

ALS Environmental

Sample Acceptance Check Form

Client: Swinomish Indian Tribal Community Work order: P2100389

Project: SwinAir

Sample(s) received on: 1/25/21 Date opened: 1/25/21 by: ADAVID

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☐	☐	☒
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were **VOA vials** checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P2100389-001.01	6.0 L Ambient Can					

Explain any discrepancies: (include lab sample ID numbers): _____

ELEMENT 13 - ANALYTICAL METHODS (B4)

13.1 - Purpose/Background

The methods stated here provide for gas chromatographic and mass spectrometric analyses of air samples collected by SITC. The basic methods used by the agency are based on the Toxic Organic and Inorganic Compendia TO-14A, TO-15, and TO-15A[4].

13.2 - Analytical Method

The main method to determine the 75 listed VOCs is by Gas Chromatography and Mass Spectrometry (GC/MS). In short, Gas Chromatography entails injecting a sample of gas into a long column filled with inert substance that slow the travel time of larger molecules. This separates the gas constituents by molecular mass. Mass Spectrometry entails ionizing the gas molecules and sorting them by their mass to charge ratio using electric and magnetic fields. The mass to charge ratios are relative to the total number of ions measured; thus, a known standard concentration is used to translate relative abundance of ions to concentration. The full analytical method and the equipment required is detailed in this section.

13.2.1 - *Analytical Equipment*

The following information was taken directly from ALS SOP for "Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)" Section 8 (Element 42). As noted in Section 8.1 the following the following instruments and/or differing models or additional may be utilized as long as they are equivalent and meet the minimum requirements.

1. Gas Chromatograph (GC)

An instrument capable of temperature programming, with a column oven that may be cooled to sub-ambient temperature at the start of the gas chromatographic run to result in the resolution of the VOCs.

Instruments listed:

- Hewlett Packard 5890 Series II Plus
- Hewlett Packard 6890 Series
- Hewlett Packard 6890A Series
- Agilent 6890N Series
- Agilent 7890A Series
- Agilent 7890B Series

2. Autosampler
    - Tekmar-Dohrmann AUTOCan Autosampler: 14-ACAN-074
    - Markes Autosampler: UNITY 2/CIA Advantage

[4] https://www.epa.gov/amtic/compendium-methods-determination-toxic-organic-compounds-ambient-air

- Concentrating Trap (cryogenic trap, built-in): 14-6938-020
- Cryofocusing Module w/split valve: 14-6520-A00
- GAST Vacuum Pump: DOA-P104-AA or equivalent coupled to the source of the mass spectrometer.

3. Mass Spectrometer (MS)

A MS capable of scanning from 34 to 350 amu every second or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for Bromofluorobenzene (BFB) which meets all of the criteria when 50ng or less of BFB is injected onto the GC/MS system.

Instruments listed:

- Hewlett Packard 5972 Series
- Hewlett Packard 5973 Series
- Agilent 5973N
- Agilent 5973 inert
- Agilent 5975B inert
- Agilent 5975C inert
- Agilent 5977A

Ionization Gauge Controller:

- Agilent: 59864B
- Granville-Phillips 330 Ionization Gauge Controller: 330001/2/3
- Hewlett Packard Ionization Gauge Controller: 59864B

4. Analytical Column

Any analytical column capable of separating the compounds of interest may be used. The capillary column should be directly coupled to the source of the mass spectrometer. The following are suggested columns; an alternative column may be used as long as sufficient peak resolution and separation is achieved.

Columns Listed:

- Restek Rxi-1ms Fused Silica Capillary Column; 30m x 0.25mm ID 1.0µm film thickness
- Restek Rxi-1ms Fused Silica Capillary Column; 60m x 0.25mm ID 1.0µm film thickness

5. Data Systems

IBM-compatible PC with Windows 95/98/NT/XP/7 (Microsoft Office EXCEL version 2003 or newer) and Hewlett Packard Chemstation software including EnviroQuant with Extracted Ion Current Profile (EICP), National Institute of Standards and Technology (NIST) library (2011 version or newer) or equivalent.

6. Canister Pressurization Station

- Vacuum/Pressure Gauge [0 to –30 inHg; 0-90 or 100 psig]

7. Dynamic Dilution System
   - Entech Dynamic Diluter Model 4620A
   - Toshiba laptop computer Model 2210CDT/6.0 and Software NT460

13.2.2 - *Analytical Methods*

The analytical methods used by ALS to determine VOC concentrations via EPA Method TO-15 can be found in ALS SOP for "Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)" Section 11 (Element 42). Below is an outline of these procedures. For more information, please see the aforementioned SOP.

1. Sample Preparation
   a. Upon receipt of laboratory, Canister pressure/vacuum is checked and pressurized on receipt with humidified zero grade air. Pressurized to 1.0 - 3.5 psig. See ALS SOP "Evaluation and Pressurization of Specially Prepared Stainless Steel Canisters" (Element 43).
      i. Initial and final pressure recorded. This determines the dilution factor.
2. Screening
   a. Analyst must scree a sample or subset of sample if unknown origin
      i. Typically, this step is skipped if it is known to be an indoor or ambient outdoor air sample.
      ii. Screening completed by injecting 1mL or smaller amount of aliquot of each sample into a GC/flame ionization detector that has been calibrated containing a subset of most commonly found compounds in air samples (i.e. acetone, trichloroethylene, and toluene). Results determine maximum volume of sample to be analyzed by TO-15.
3. Data System
   a. Depending on the GC/MS, load the appropriate data acquisition program
4. Conditions
   a. See ALS SOP for "Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)" Section 11.6 (Element 42).

Table 13-1: Instrument Settings

Equipment	System Parameters	Conditions/Settings
Adsorbent Trap	Set Point: Sample Volume: Dry Purge: Sampling Rate: Desorb Temp.: Desorb Flow Rate: Desorb Time:	35° up to 1L 300mL 100mL/min (utilize for a sample injection volume of >100mL); 40mL/min (utilize for a sample injection volume of 25-100mL) 200°C to 230°C 8-10mL/min He, measured at refocuser split vent 3.0 minutes

Refocusing Trap	Temperature: Injection Temp.: Injection Time:	-180°C 160°C 1.0 min
Adsorbent Trap Reconditioning Conditions	Temperature: Initial Bakeout: After each run:	Sample Run Time 265°C 3 hours or until clean blank is obtained 5-8 minutes
Sample Run Time	Run: Total Cycle:	approximately 20 minutes long about 30 minutes between injections
Optimize GC conditions for compound separation and sensitivity.	Carrier Gas: Flow Rate: Temperature Program: Detector B (MSD Interface): Electron Energy: Mass Range (Scan mode): Mass Range (SIM mode) : Scan Time Condition:	Helium 1.0-1.6mL/minute Initial Temperature: ~20°C Initial Hold Temperature: 3 minutes Ramp Rate: 5°C/min to 80°C 2nd Ramp: 10°C/min to 160°C 3rd Ramp: 20°C/min to 240°C for 5 min hold 260°C 70 Volts (nominal) 34 to 280 amu Scan masses corresponding to the target analytes To give at least 10 scans per peak, not to exceed 1 second per scan.

5. Sample Concentration
    a. Sample Container is at temperature equilibrium with lab
    b. Connect to Auto-Sampler; ensure leak tight with software check
    c. Auto-sampler concentrates 1 L of Canister contents on a solid adsorbent trap (either cryogenically or fan cooled glass beads or stronger adsorbents at higher temperatures) to collect the analytes of interest
    d. Water Vapor removed in a dry purge step
    e. Sequential traps are used to transfer the sample to the column head
6. Sample Analysis
    a. SCAN Mode is run:
        i. MS scans the atomic range from 34 to 270 amu
        ii. Ten scans per eluting chromatographic peak should be acquired
        iii. Generate a quantitation report for each run.
            1. If Manual integration needed see ALS's SOP on Manual Integration (Element 44)
    b. SIM Mode can be run upon request. SITC will not request this for Ambient Samples described in this QAPP.

13.2.3 - *Analysis Sequence*

The analysis sequence involves the following different procedures.

1. Instrument Performance Checks (Tune Check)
2. Initial Calibration Standard (ICAL)
3. Initial Calibration Verification Standard (ICV)

4. Continuing Calibration Verification (CCV)
5. Method Reporting Limit Check Standard (MRL Check)
6. Canister Quality Control Check (CQCC)
7. Method Blank (MB)
8. Laboratory Control Sample (LCS)
9. Laboratory Duplicate (LD)

The following generalized analytical sequence must be completed for analysis of ≤ 20 field samples.

1. With Calibration
    1. Tune Check (See Element 16 for more information)
        a. The instrument performance check solution must be analyzed initially and once per 24 hour. All analyses for a sequence must be initiated (injected) prior to the expiration of the tune window.
    2. ICAL (5 Standards Minimum)
    3. ICV Standard (Acts as the ICV and LCS)
    4. CQCC
        a. May be analyzed in the sequence to determine canister cleaning batch (or batches) acceptability
    5. MB
        a. Any of the QC check Canister may serve as a Method Blank (MB) as long as the minimum requirements are met
    6. Sample(s) – 1-20
    7. LD

        Shall be analyzed at a rate of 1 in 20 (or fewer) samples; must be rotated among clients whenever possible.
2. With Continuing
    1. Tune Check
        a. The instrument performance check solution must be analyzed initially and once per 24 hour. All analyses for a sequence must be initiated (injected) prior to the expiration of the tune window.
    2. CCV
        a. CCV must be analyzed at the beginning of every analytical sequence that does not begin with a Calibration
    3. CQCC
        a. May be analyzed in the sequence to determine canister cleaning batch (or batches) acceptability
    4. MB
        b. Any of the QC check Canister may serve as a Method Blank (MB) as long as the minimum requirements are met
    5. LCS
    6. MRL Check Standard

   c. Method Reporting Limit (MRL) check standard may be analyzed with each batch of 20 (or fewer) samples when initial calibration is not analyzed in the same batch
7. Sample(s) – 1-20
8. LD
   d. Shall be analyzed at a rate of 1 in 20 (or fewer) samples; must be rotated among clients whenever possible.

ELEMENT 14 - QUALITY CONTROL REQUIREMENTS (B5)

14.1 - Critical Criteria

Observations that do not meet each criterion on the Critical Criteria Table should be invalidated unless there are compelling reasons and justification for not doing so. Basically, the sample or group of samples for which one or more of these criteria are not met is invalid until proven otherwise. The cause of not operating in the acceptable range for each of the violated criteria must be investigated and minimized to reduce the likelihood that additional samples will be invalidated. Flag codes are listed in Element 19, Table 19-2 and 19-3.

Table 14-1: Critical Criteria for VOC Measurements

Parameter	Requirement	Acceptance Criteria Detail
Field Sampling – Responsibility of SITC		
Sampling Period	24 hours	±1 hour
Field Sampling – Responsibility of ALS		
Canister Cleanliness Certification	One canister per batch cleaned	≤ 0.2 ppbv per analyte or MDL, whichever is greater
Flow Controller Verification	Flow Controller tested upon receipt from Field	≤20% between the initial calibration and post-calibration check
Analysis – Responsibility of ALS		
Mass Spectrometer (MS) Tune Check	Daily or every 24 hours	Meets Method TO-15 criteria (Table 14-3)
Initial Calibration Levels Frequency	Multipoint calibration: 5 or 6 points, ranging from 0.25 to 15 ppbv. At least quarterly or after failure to meet acceptance criteria or after major change in instrumentation.	Relative standard deviation (RSD) of response factor ≤ 30%. Relative retention time (RRT) for analytes ±0.06 retention time units from mean retention time in multipoint calibration.
CCV Frequency	Daily	± 30% bias from mean response factor from multipoint calibration

14.2 - Operational Criteria

Criteria that are important for maintaining and evaluating the quality of the entire data collection system are included in this Operational Criteria Table. Violation of one or more of these

requirements may be cause for invalidating a set of data. The decision should consider other quality control information that is available. The dataset for which one or more of these criteria are not met will be considered suspect unless other quality control information demonstrates that the data are valid. The reason for not meeting these criteria MUST be investigated, fixed, or justified.

Table 14-2: Operational Criteria for VOC Measurements

Parameter	Requirement	Acceptance Criteria Detail and Flag
Field Sampling – Responsibility of SITC		
Field Blank	Twice per year; includes Shut-in test	All analytes %CV < 15% from MRL
Field Collocation Samples	Once per quarter; inlets within 3 meters both vertically and horizontally	< 15% CV (or %CV < 15% from MRL if samples differ if analyte is above MRL)
Shut-in Test	Pressure Drop not exceed 1 "Hg in 3 minutes; repeat after adjustments	< 1 "Hg in 3 minutes
Field Sampling – Responsibility of ALS		
Sampler Certification Zero	Humidified Zero Air or Nitrogen. Performed prior to field deployment, annually thereafter, and/or after any major component repair.	≤ 0.2 parts per billion by volume (ppbv) per analyte or MDL, whichever is greater
Analysis – Responsibility of ALS		
ICV/ Frequency	Following the calibration curve	±30% bias from mean response factor from multipoint calibration
Method Blank Frequency (Also can be QC Check on Canister Cleaning)	Clean canister filled with humidified air Daily, prior to sample analysis	≤ 0.2 ppbv per analyte or MDL, whichever is greater
Duplicates Analysis Frequency	Replicate laboratory analysis of duplicate or collocated field samples	< 25% relative percent difference (RPD) for analytes > 5 H MDL
MRL Check Standard	If Requested OR if CCV biased Low	3:1 signal to noise ratio detected; ±50%.

14.3 - Systematic Criteria

Criteria which are important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples are included on the third table, the Systematic Issues Table. For example, the data quality objectives are included in this table. If the data quality objectives are not met, this does not invalidate any of the samples, but may indicate possible introduction of error.

Table 14-3: Systematic Criteria for VOC Measurements

Parameter	Requirement	Acceptance Criteria Detail and Flag
Field Sampling – Responsibility of SITC		
Performance Evaluation: Comparison with NOAA	CFC-11 and CFC-12 monitoring results	< 20% Difference in Monthly averages
Sampling Site Specification	2-15 m above ground, 1 m from obstructions; on windward side of obstruction if <2x the height of the obstruction away from obstruction; collocated samples within 3 m both horizontally and vertically	Not exceed required site specifications listed.
Analysis – Responsibility of ALS		
Holding Time (Days)	30 days from sampling	Not Applicable
Spike/Surrogates	Same Volume added to Samples, Standards, and QC Checks at analyzer	Acceptable recoveries are between 70 - 130%.
Internal Standards Frequency	Every standard, blank, and sample	Area response within ±40% of most recent calibration check Retention time ±0.33 min of most recent calibration check

14.4 - QC Procedures

The procedures used to ensure the Critical, Operational, and Systematic Criteria are met are listed by SITC and Laboratory Procedures below.

14.4.1 - *SITC Procedures*

SITC is responsible for ensuring that field based activities do not impact bias or accuracy in all sample collection activities. Thus the following checks are completed:

1. Bias Checks - Field Blank (FB)

a. An evacuated canister is sent to the field and kept in the same conditions as other field samples except being used to take a sample.
    1. Sample will be:
        1. Kept in the same location as other samples
        2. Removed from box
        3. Shut-in test performed:
b. Cap removed, flow controller added, test pressure loss at the location the Shut-in test is performed for other canisters
    1. Returned to box. Shipped together.
        1. Sample is flagged in naming convention as "FB"
        2. When arriving at the Laboratory, Canister will be pressurized using humidified zero air and treated as a normal sample.
c. Acceptance Criteria:
    1. All analytes < 3 times MRL
d. Corrective Action:
    1. Repeat Field Blank
    2. If Field Blank fails again, storage and locations of Shut-In tests should be investigated for possible influences to determine the source of contamination

2. Precision Checks - Collocated Field Samples
    a. While we are not using TO-15A Method, we will be using the method as guidance on Field Duplicates/Colocation to ensure precision in our Field Methods.
        1. 5% of samples or at a minimum of 3 samples (whichever is higher), field samples will be taken at each field site in duplicate/triplicate.
        2. Scheduled to occur ONCE per quarter
    b. Siting Specifications:
        1. Inlets are < 3 m apart horizontally and < 3 m apart vertically
        2. Inlets are 2-15 m above the ground
    c. Canisters will be:
        1. Kept in the same location as the other samples
        2. Removed from box
        3. Shut-in test preformed:
            1. Cap removed, flow controller added, test pressure loss at the location the Shut-in test is performed for other canisters
        4. Samples taken; returned to box and shipped together.
    d. Acceptance Criteria:
        1. < 15% CV
    e. Corrective Action:
        1. Repeat Field Collocated Sample
        2. If Field Blank fails again, storage, locations of Shut-In tests, and sampling methods should be investigated for possible influences to determine the source of contamination

14.4.2 - *ALS Procedures*

ALS complies with the QA procedures outlined in their QA Manual (Element 45)

ALS includes procedures for each of the following Quality Control Verifications/Checks in the ALS SOP for "Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS)" (Element 42) in Section 11. Quality Control Requirements and Corrective Action are listed in Section 12. The procedures include, but are not limited to:

1. Calibrations/Control Standards (ICAL, ICV, CCV)
2. QC Checks (MB, CQCC*, LD, and MRL Check)
3. Spikes/Surrogates
4. Sample Holding Time Expired

*QC Checks are described in "Cleaning and Certification of SUMMA Canisters and Other Specially Prepared Canisters" (Element 38)

As part of ALS service is to provide quality control, ALS will ensure all samples:

1. must be quantitated from the initial instrument calibration and may not be quantitated from any continuing instrument calibration verification.
2. must be analyzed on a GC/MS system meeting the BFB tuning, initial calibration, initial calibration verification technical acceptance criteria.
3. All target analyte peaks must be within the initial calibration range, diluted or reported with the appropriate data qualifier.

In addition, when corrective actions are made, samples analyzed while the instrument was not functioning properly must be re-analyzed or the appropriate data qualifiers must be attached to the results. To the extent possible, samples shall be reported only if all of the quality control measures are acceptable. If a quality control measure is found to be out of control, and the data must be reported, all samples associated with the out of control quality control measure shall be reported with the appropriate data qualifier(s).

14.5 - Data Evaluation and Decision-Making Process

To determine if the MQOs are followed, Table 14-4 lists the equations needed to determine %CV to evaluate if our operational criteria are being met.

If all criteria are met, the approved data will be used to calculate monthly and yearly means. The monthly means will only be done for CFC-11 and CFC-12 as part of a Performance Evaluation of our measurement. Yearly averages will be used to determine cancer risk and hazard quotients due to ambient HAP concentrations. Yearly averages will also be compared to WA state ASILs as appropriate.

Table 14-4: Equations

In the following table, the subscripts "k" indicates the analyte while "N" indicates the number of samples (population) that is used to calculate the mean or standard deviation. Occasionally the MDL is substituted for a "ND" value when one sample in the population does not detect that specific analyte in order to determine the mean or standard deviation.

Criterion	Equation
Mean: Calculate the Population Mean in order to calculated the %CV to assess Field Blank, Field Collocated Samples, and Laboratory Duplicates.	$\mu_k = \frac{\sum_{i=1}^{i=N} C_{i,k}}{N}$
Standard Deviation: Calculate the Population standard deviation in order to calculated the %CV to assess Field Blank, Field Collocated Samples, and Laboratory Duplicates.	$\sigma_k = \sqrt{\frac{\sum_{i=1}^{i=N}\left(C_{i,k} - \mu_k\right)^2}{N}}$
Field Blank: For each Analyte that is NOT below the MDL (i.e. not "ND") calculated the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) in the Field Blank and the Laboratory determined MDL ($C_{2,k}$). **Field Collocated Sample and Laboratory Duplicates:** 3. For each Analyte for which BOTH collocated samples or Laboratory duplicates are ABOVE the MDL, calculate the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) in the Sample and the Analyte concentration in the Field Duplicate or Laboratory Duplicate ($C_{2,k}$). 4. For each Analyte for which only ONE of the collocated samples or Laboratory duplicates are NOT below the MDL (i.e. not "ND") calculated the Coefficient of Variation between the Analyte concentration ($C_{1,k}$) above the MDL in the Sample/Field Duplicate/Laboratory Duplicate and the Laboratory determined MDL ($C_{2,k}$).	$\%CV_k = \frac{\sigma_k}{\mu_k} \times 100\%$
Monthly Averages ($\mu_{m,k}$): For CFC-11 and CFC-12 Used for Performance Evaluation of CFC detection. (On this case "k" only indicates CFC-11 or CFC-12).	$\mu_{m,k} = \frac{\sum_{i=1}^{i=N_m} C_{i,k}}{N_m}$
Absolute Percent Difference ($\%D_k$): Calculate the percent difference between the calculate monthly mean of samples taken at one site location ($\mu_{m,k}$) and the monthly mean observed at NOAA's NWR site ($\mu_{NWR,k}$)	$\%D_k = \frac{\mu_{m,k} - \mu_{NWR,k}}{\mu_{NWR,k}}$
Yearly Averages ($\mu_{m,k}$): Calculate the Yearly Averages over all samples (N_y) taken within one year for each analyte.	$EC_k \approx \mu_{y,k} = \frac{\sum_{i=1}^{i=N_y} C_{i,k}}{N_y}$

Criterion	Equation
Estimated Long-term Concentration Exposure (EC_k): Calculate the EC_k either using the Yearly Average as an approximate for < 3 years of data. After 3 years, use an average of the yearly averages where N_z is the number of years for which yearly Averages have been done.	$EC_k \approx \mu_{y,k}$; < 3 years of data $EC_k = \sum_{i=1}^{i=N_z} \mu_{y,k,z}$
Risk (per analyte): Calculate the estimated incremental lifetime cancer risk for an individual due to exposure to a specific air toxic ($Risk_k$) using the calculated $EC_k$and the URE for that particular HAP listed in Table 7-1.	$Risk_k = EC_k \times URE_k$
Risk (TOTAL): Calculate the estimated incremental lifetime cancer risk for an individual due to exposure to all monitored HAPs by summing the risks for the individual HAPs.	$Risk = \sum_{i=1}^{i=k} Risk_i$
HQ (per analyte): Calculate the hazard quotient for an individual air toxic (HQ_k) using the calculated $EC_k$and the RfC for that particular HAP listed in Table 7-1	$HQ_k = \frac{EC_k}{RfC_k}$
HQ (TOTAL): Calculate the hazard quotient for all monitored HAPs by summing the risks for the individual HAPs.	$HQ = \sum_{i=1}^{i=k} HQ_i$

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. Ensuring that all analytical equipment is working is the sole responsibility of ALS.

The only responsibility of SITC in instrument test, inspection and maintenance are the “Shut-In” test that are completed prior to sampling.

15.1 - Shut-In Tests

Shut-In Tests are used to determine if any of the joining parts of the flow controller and the canister are leaking prior to sampling. This is to ensure that the flow into the canister is the calibrated value of the flow controller and not higher because of leaks. A detailed description of this test is detailed in the attached SOP in Element 35 section 10.4.2.

ELEMENT 16 - INSTRUMENT CALIBRATION (B7)

16.1 - Instrumentation Requiring Calibration

1. GC/MS
2. Flow Controllers

16.2 - Calibration Method that Will Be Used for Each Instrument

16.2.1 - *GC/MS*

1. Initial Calibration
    a. 5-concentrations points per analyte; lowest calibration point sets the method reporting limit (MRL); higher points must not exhibit peak saturation
        i. Initial Calibration (ICAL) Standards need to be prepared with nominal concentrations of 1ng/L (optional), 20ng/L and 200ng/L for analyses in SCAN mode and 0.1ng/L, 5.0ng/L, and 200ng/L for analyses in Selective Ion Monitoring (SIM) mode for each of the target analytes.
        ii. Analyze the ICAL (analyze low to high) that span the monitoring range of interest of the samples.
    b. Must occur annually or when verification outside acceptance criteria. Recalibration must occur following any instrument maintenance that may impact the sensitivity or linearity of the instrument
    c. The Standard Concentrations for each analyte is listed below in :

Table 16-1- Standard Concentrations (SCAN), Primary Sources for ICAL and CCV

Compound Name	0.1 ng	0.2 ng	0.5 ng	1.0 ng	5.0 ng	25 ng	50 ng	100 ng

16.2.2 - *Flow Controller Calibration*

The following is a summary of the procedures outlined in Element 39 for the Calibration and Calibration Check of Flow Controllers:

1. Calibration/Verification
    a. Flow Controllers are connected to an evacuated canister (<20 “Hg vacuum)
    b. Inlet of Controller is attached to Flow Meter and canister valve is opened.
        i. Flow Meter must be traceable to NIST standard; certificate on file.
        ii. Connection tubing material is clean, flexible silicone tubing
    c. Flow Controller is adjusted to desired sampling rate:
        i. 24-hour sampling rate determined by the following Equation:

$$\mathrm{F} = \frac{0.85V}{t} \times \frac{1000\ mL}{1\ L}$$

1. Where F is the flow rate, t is the time (1440 minutes), and V is volume of canister in Liters (6 L)
2. For a 24 hour sample the flow rate should be: 3.54 mL/min

ii. The coarse adjustment (using a flat head screw driver) is used to get the Flow Controller within 1-2 mL/min
iii. The fine adjustment (using a small screw driver) is set to the center position before adjusting. Set to unit rate in mL/min.
iv. Measure stable flow rate; record in e-Logbook

2. Flow Meters are Secured after Calibration to avoid accidental or willful changes

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

17.1 - SITC

The following are critical consumables and supplies for all field activities used by the Swinomish AQ Program. Acquiring, storing, and tracking the Supplies and Consumables listed are the responsibility of AQSp and AQT.

17.1.1 - *Consumables*

- Teflon Tape
- Packaging Tape
- Chain of Custody Logs – From ALS

17.1.2 - *Equipment/Supplies*

- Wrenches
- Chains
- Locks
- Keys
- Scissors
- Pen
- Canister Stand

17.2 - ALS

ALS is in charge of identifying critical supplies and consumables for their laboratory, noting supply source, ensuring acceptance criteria, and following ALS's internal procedures for tracking, storing and retrieving these materials. The PM at ALS is responsible for delegating tasks and ensuring their completion.

ELEMENT 18 - NON-DIRECT MEASUREMENTS (B9)

18.1 - NRMC WRF Model

18.1.1 - *Model Description*

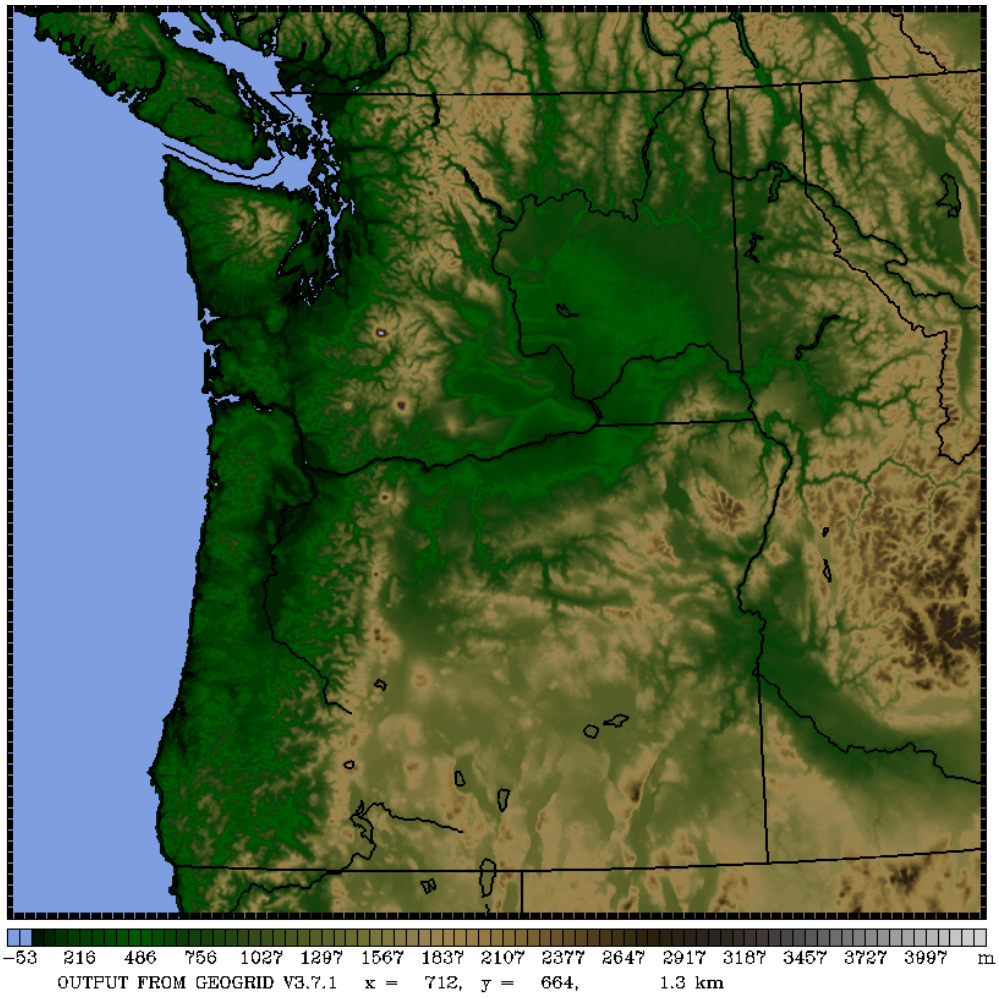
The Northwest Regional Modelling Consortium (NRMC) operates high-resolution environmental prediction models over the Pacific Northwest. NRMC is sponsored by a consortium of local, state, and Federal agencies including Swinomish Indian Tribal Community. For this project, we utilize model products from 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. Figure 18-1 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.

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



18.1.2 - *Model Decision*

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.

18.1.1 - *Model Use*

The WRF soundings and trajectories are used purely to understand the likely weather conditions for the next couple days. This will be incorporated into determining sample location and day/time. The trajectories and soundings used for forecasting purposes will be saved for future reference.

If model runs are late, emails are sent to all NRMC members. The next available model run will be used to do forecasting.

18.2 - NOAA Halocompound Monitoring

Atmospheric Measurements from the NOAA/ESRL Chromatograph for Atmospheric Trace Species (CATS) will be used to do Performance Evaluations of our ambient HAPs monitoring by comparing NOAA/ESRL halocarbon concentrations to those determined in our results at SITC.

Chloroflurocarbon-11 and Chloroflurocarbon-12 are long lived gases in the atmosphere and thus concentrations are relatively similar (within 20%) at all surface locations. So, while not monitoring the exact same location, the NOAA/ESRL data is a comparable benchmark for CFC-11 and CFC-12 concentrations.

CFC-11 and CFC-12 data is collected from hourly in situ samples analyzed on a gas chromatograph located at Niwot Ridge (NWR), Colorado. The site is located at 40.04°N, 105.54°W with an elevation of 3018 m.

While the CATS GCs sample air once an hour, for our auditing purposes we will be utilizing the monthly averages to compare to our own monthly averages as data does not always exist for every day sampled. Monthly median data are provided in parts-per-trillion, ppt.

The data can be accessed from the following website.
https://www.esrl.noaa.gov/gmd/dv/data/index.php?category=Halocompounds

ELEMENT 19 - DATA MANAGEMENT (B10)

19.1 - Recording

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.

Procedures for data acquisition are provided in our SOPs, Raw Data, and QA/QC Data from ALS are obtained within a month from the sampling date and are handled in accordance with the requirements listed in the tables in Element 9.

The data are stored in an excel file "TO-15_Database" until a SQL database is developed for the AQ Program (ETA 2022). In summary, the data are downloaded as raw data and QA/QC files as an excel and PDF file, respectfully. These are immediately placed on the SITC2 network and copies are created and placed in the "BACKUP" section of the AQDB portion as described in Section 9 (I think I need to add this… to Section 9). The network - and thus the database itself - is fully backed up weekly via the Veritas NetBackup Solution to a server named US-Ellinor. It is backed up incrementally every evening, and completely backed up every week. This is managed by the Swinomish IT Department.

19.2 - Transmittal and Verification

Data transmittal occurs when information is transferred from one person or location to another, or copied by hand or electronically, from one form to another. For this project, examples of data transmittal includes, but is not limited to:

- copying files (PDF and CSV files) from the AQT's or AQSp's computer (outlook email from ALS) to the department server.
- Copying QA/QC'd data from laboratory reports (pdf files) into the TO-15_DATABASE.xlsx file.
- Transcribing notes and date/time stamps from an eLogbook into the Metadata part of the database
- QC forms and checklists

At the beginning of our program, personnel change, or if a new data management/database is implemented, 100% of all information transcribed by hand into a computer file is verified to be correct by supervisor. The documentation of these verifications will include what information/sources were compared, results, name, and date/findings will be documented in the QA/QC Checklist for Discrete Sampling of VOCs and emails to supervisor(s) summarizing the verification as an informal internal report.

After no data entry errors are identified in at least 3 consecutive data entry processes, the program will implement quarterly verification of one transfer of sample results into database. The program will resume verification of every data entry process if errors are found or whenever operations change (new people, database edits, QA/QC forms, etc.).

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 the Site Operator and the Air Department Director have rights to access the system.
- Server and individual computer password changes (quarterly for continuing personnel; passwords for outgoing personnel will be cancelled immediately);

19.4 - Data Transfer Guidelines

This section lists the requirements for transferring data.

19.4.1 - *Frequency*

ALS compiles and sends 1) Raw CSV data file and 2) PDF File with ALS QAQC analysis and ALS Data Quality Flags. These emails are sent usually within a month of sample collection. Within one week of receiving the results email from ALS, the files will be transferred to the respective folders under N:/A/1/4_AQDB as detailed in Element 9.

19.4.2 - *Intervals*

The data interval over which we gather data is 24-hours. Our objectives utilize an annual average which will be calculated assuming days without sampling that most analytes (except CFC-11 and CFC-12) are zero. If our objectives change, the intervals over which we collect data will be changed along with this QAPP.

19.4.3 - *Downloading Data*

In general, these steps are followed for transferring the data to the database:

1. Within one week of receiving results from ALS, the PDF file is saved to the LABORATORY folder under QAQC on the network, and the CSV file is saved to the LABORATORY folder under the RAW folder on the network. See Element 9 for more details.
2. A copy of both files will also be saved as in the BACKUP folder and set as read-only. To set the file as read-only, we right-click on the file, select “properties,” and set as read-only. The file name and download date are recorded in the eLogbook for Discrete VOC sampling.
3. Check for flags. Note presence of codes in the aforementioned eLogbook page with any analyte analysis impacted and comments. Take notes even if all is running well.
4. Enter all relevant data and metadata into the TO-15 DATABASE file, following the SOP for VOC Canister Collection under the Section for Database Entry.

19.5 - Criteria for Data Review

Data review has two major components. The first is conducted by ALS who flags data with Data Quality Flags and presents a Case Narrative addressing all QC concerns. These Data Quality Flags are listed here:

Table 19-1: ALS Data Quality Flags

Code	**Meaning**
ND	Not Detected
V	The continuing calibration verification standard was outside (biased low) the specified limits for this compound
L	Laboratory control sample recovery outside the specified limits, results may be biased high.
	(ALS has not provided a list of DQF, this chart will be updated as we see new ones)

The second component of data review includes those imposed based on additional information:

1. Common sense and experience, (i.e. checking Canisters ID are the same, checking volume sampled is 1 L, etc.)
2. QC check results within satisfactory range and bracket the time period of the data, which are listed in the program QAPP (Elements 14(B5) and 7(A7)) and are fully documented,
3. Specific requirements or other data being available for that time period, such as CFC background concentrations comparable to national monitoring, which in all cases will be fully documented in the eLogbook page for Database entry and available for assessments.

19.6 - Data Review Documentation

The following requirements will be met by our program with specific procedures described in our SOPs. The results of these data review operations are documented in a short QA section of the quarterly report, summarizing what checks were conducted and if errors were found, how they were rectified and the system improved to reduce future errors. These operations will be conducted by the Site Operator, prior to the data being reviewed by the QA Reviewer.

1. Even when there has been no evidence of data entry or transfer errors, the following data will be verified at least every quarter so that approximately five percent of the values reported out are verified for accuracy:
    1. Individual sample values: Quarterly, approximately 2,700 values are transferred from ALS reports into the Database. One sample will be randomly chosen by the QA Reviewer for verifying the correct reporting of the 24-hour averages. This

will be done by referring to the original raw data and comparing that sample's original "raw" value to the value in the TO-15_DATABASE.xlsx file.

2. At least four of the aggregated averages (as used in reports, such as yearly averages) reported in an annual report will be verified by using excel to verify the accurate reporting.

2. Currently, information is entered manually into the database on the network. In the future, opportunities for mistakes will be minimized by reducing manually-entered information as much as possible by using the automated Sequel database and using consistent, documented import/export procedures so entire files or selections of records are transferred.
3. A strict file and folder naming protocol and hierarchy is used. It will change, be improved, and extended to accommodate more data management as the program grows. When modified, the revised policy is posted for easy referral and used scrupulously. Data will be processed from raw to reviewed (through QA/QC checks), to final validation, to use in reports and charts, and then manipulated to construct seasonal or annual averages. In addition, the program will evaluate data in comparison to outside data when possible. It is very important to track file revision numbers/dates to avoid confusion.
4. Our program has a strict policy of logging all data file manipulations in the database eLogbook, including folder and filenames, purpose, what was done, and date/time. The person logging the information will record sufficient detail to allow someone else with access to the files the ability to reconstruct the operations. The database eLogbook is used in the final data validation procedure (SOP for Final Data Validation) and the logbook itself is downloaded as a PDF at least quarterly. Changes to filenames and file locations are recorded in the file directory, located here: \\SITC2\Planning\USER\WATER\6_AIR_QUALITY\A_AIR_PRG\1_AMBIENT_AQ_PROGRAM\4_AQDB\BACKUP_README_METADATA

19.6.1 - *Storage*

Physical carbon copies of chain of custody records are retained on file at the Swinomish Air Quality Monitoring Station 1 for a minimum of five years and are readily available for audits and data verification activities. After five years, all paper records and computer backup media are scanned (if not already), assembled into quarterly report packages by year, and boxed for storage.

19.6.2 - *Data Qualifiers*

The Swinomish Air Quality Program will flag a data value that does not meet certain criteria, either in the initial data acquisition (caused by instrument or other source error and instrument flags alerting the Site Operator), in the import process (out of range, etc., see table 19-2 for list of qualifiers), after receipt of reports of audits, or for environmental release (controlled burns, industrial releases, surges in traffic or fireworks due to ceremonies or festivals, etc.). Final codes for data invalidation are assigned after carefully evaluating the data in context of supporting information (e.g., wind roses, data from nearby sites, supporting meteorological data).

Qualifiers (flags, in a separate column, not overwriting original data) assigned during data import, verification and validation, are listed in Table 19-2. Most of these were taken from AQS Flags to be consistent with other data flagging activities.

Table 19-2: Internal Qualifiers (Flags)

Code	Qualifier Description	Code	Qualifier Description
AA	Sample Pressure out of Limits.	AS	Poor Quality Assurance Results.
AB	Technician Unavailable.	AW	Wildlife Damage.
AC	Construction/Repairs in Area.	BB	Unable to Reach Site.
AD	Shelter Storm Damage.	BE	Building/Site Repair.
AF	Scheduled but not Collected.	BH	Interference/co-elution/misidentification.
AG	Sample Time out of Limits.	BI	Lost or damaged in transit.
AH	Sample Flow Rate or CV out of Limits.	BJ	Operator Error.
AI	Insufficient Data (cannot calculate).	BM	Accuracy check / collocated sample.
AL	Voided by Operator.	CS	Laboratory Control Sample.
AM	Miscellaneous Void.	DA	Aberrant Data (Corrupt Files, Aberrant Chromatography, Spikes, Shifts).
AO	Bad Weather.	MB	Method Blank (Analytical).
AP	Vandalism.	TS	Holding Time Or Transport Temperature Is Out Of Specs.
AQ	Collection Error.	XX	Experimental Data.
AR	Lab Error.		

Table 19-3: QA/External Qualifiers (Flags)

Code	Qualifier Description	Code	Qualifier Description
1	Deviation from a Critical Criteria Requirement.	MS	Value reported is 1/2 MDL substituted.
1V	Data reviewed and validated.	MX	Matrix Effect.
2	Operational Deviation.	ND	No Value Detected, Zero Reported.

3	Field Issue.	NS	Influenced by nearby source.
4	Lab Issue.	QP	Pressure Sensor Questionable.
5	Outlier.	QX	Does not meet QC criteria.
6	QAPP Issue.	SQ	Values Between SQL and MDL.
CB	Values have been Blank Corrected.	SS	Value substituted from secondary monitor.
DI	Sample was diluted for analysis.	SX	Does Not Meet Siting Criteria.
EH	Estimated; Exceeds Upper Range.	TB	Field Blank Value Above Acceptable Limit.
FB	Field Blank Value Above Acceptable Limit.	TT	Transport Temperature is Out of Specs.
HT	Sample pick-up hold time exceeded.	V	Validated Value.
LB	Lab blank value above acceptable limit.	VB	Value below normal; no reason to invalidate.
LJ	ID of Analyte Is Acceptable; Reported Value Is An Estimate.	Y	Elapsed Sample Time out of Spec.
LK	Analyte Identified; Reported Value May Be Biased High.	8	QA/QC Unknown.
LL	Analyte Identified; Reported Value May Be Biased Low.	PQ	Values Between PQL And MDL.
MD	Value less than MDL.		

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.

20.1 - Network Reviews

The network review is a review conducted at least every three 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 ECM, 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 NATTs or Modelling studies such as the NATA.
- Changes in scientific understanding of health impacts of HAPs
- Hindcasts for each sampling period done 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 3 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)).

20.2 - Performance Evaluations

Performance evaluations are a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory. They may involve side-by-side comparisons of concentrations or flow rate, but they result in quantitative numeric values. In general, the difference between the parameter from our instrument is compared against the parameter from the external instrument and a statistic such as relative percent difference is calculated.

As VOC sampling is a newer technology and monitoring is sparse. However, we do include monitoring of CFC-11 and CFC-12 which are well mixed throughout the atmosphere and monitored by NOAA at multiple sites. This data is available to the public and thus can be used to evaluate the performance of our monitoring by comparing these two specific analytes. Such performance evaluations (template in Element 46) are conducted in accordance with the schedule in element 14 (B5) Successful evaluations require an agreement of less than 20% between the NOAA's reported monthly averages and the tribe's monthly averages of CFC-11 and CFC-12.

ALS is responsible for Performance Evaluations of all GC/MS equipment and all auditing necessary to ensure analytical instruments meet requirements of the TO-15 Method. Documentation of such Audits or Evaluations are kept by ALS.

20.3 - Data Quality Assessments

Data quality assessments are statistical and scientific evaluations of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use.

Data quality assessments are conducted by the AQSp, using the reports in the database that provide summary statistics. Annually or as needed as determined by the AQSp and the QA Reviewer may provide additional assessments.

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
Laboratory Reports	ALS	AQSp, AQT	1/analysis request (could include multiple samples); within 1 month after ALS receives sample
Final Data Validation Report	QA Reviewer	AQSp, ECM, DDEP	1/quarter; 30 days or less after collocation sample
EPA Quarterly Reports	AQSp	India Young	1/quarter; 30 days after quarter ends
EPA Annual Reports	AQSp	India Young	1/year; 90 days after year ends
SITC DEP Annual Reports	AQSp	DEP	1/year; 30 days after year ends

21.1.1 - *Laboratory Reports*

ALS generates a Laboratory Report for every analysis request. The report includes:

1. Letter from the Project Manager at ALS indicating receiving date of sample, service request number, and assurance statement that all analyses are "performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program."
2. Case Narrative
    a. Information on Chain of Custody
    b. Information on Analysis method
    c. QA information; spike recoveries issues if the occur, Canister cleaning info
3. Certifications, accreditations, and registrations
4. Detail summary Report
5. Copy of the Chain of Custody Record & Analytical Service Request Form

6. Copy of the Sample Acceptance Check Form
7. Analysis results of:
    a. Sample(s)
    b. Method Blank
    c. Laboratory Control Sample
    d. Spike Recovery
    e. (If done) Laboratory Duplicate

21.1.2 - *Final Data Validation Report*

The Final Data Validation Report (Element 47) is completed by the QA Reviewer after the completion of the QAQC Checklist. The report consists of:

1. List of Sample Results entered over the review period (usually a quarter)
    a. Includes Date entered, Date Finalized
2. Location of eLogbooks on Network (ensuring the eLogbook was downloaded)
3. Summary of findings from QAQC Checklist,
    a. Issues (if any) encountered in Forecasting Data Management
    b. Issues (if any) encountered in Sample Collection Data Management
    c. Issues (if any) encountered in Database Entry
    d. Issues (if any) encountered in QC Checks
    e. Recommendations of future Data management

DATA VALIDATION AND USABILITY (Group D)

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

Data verification is the process of checking and documenting 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 shown in Table 22-1. Database verification uses the limits which are detailed in this QAPP as tables 14-1 through 14-3, 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 14-1: Critical Criteria Table apply to every record of data. If any particular data point does not meet each and every criterion on the Critical Criteria Table, that point should be invalidated unless there 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 the Table 14-2: Operational Criteria Table 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 the Table 14-3: Systematic Data Table 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.

Table 22-1: Data Review Sequence and Requirements

Stage and Data Identification	QA Objective	Requirements
Raw	Original unchanged sample data produced by laboratory analysis; to be archived as raw data. This "raw" data does have embedded error codes and flags in records that do not meet the instrument's error checks, so there is some element of QA even in this "raw" data. The objective of handling this data is to not overwrite or eliminate any information.	Database includes a METADATA tab which includes raw data filenames, path, number of records, date/time start/end. eLogbook includes information taken at time of sample in addition to notes on database entry.
Initial (QAQC and METADATA Tabs)	Database functions include several components of data review as raw data is imported into the database. This is to determine if: • Ranges are as expected for this pollutant/sampler/season, • instrumentation problems occurred, as documented by instrument flags or error codes provided by ALS, • units are correct, • there are missing records in the dataset. • QA/QC Information (Spike Recovery Values, MB, and LCS) are all within QC limits • CFC-11 and CFC-12 comparison to NOAA standards • Sample duration within limits	Data is flagged using unique codes so suspect data can be easily identified for further evaluation and no original data overwritten.
Intermediate (QAQC and METADATA Tabs)	Intermediate data review is conducted Quarterly: • Collocated Sample Accuracy Pass • Field Blank Pass (bi-annual) • Flag data affected by the timing or results of QC checks, maintenance, repair, or other operations (all valid data must be bracketed [before and after] with passing QC Checks in accordance with the frequency in the Element 14 tables) • Flag data potentially affected by additional information (audit reports, manufacturer correspondence, local conditions reports [controlled burns], or other information.) • QAQC Checklist completed	Assignment of flags are coded to allow the database operator to easily identify data that may be invalid prior to final data validation.

Final (FINAL sheet)	Quarterly, conduct final data validation to make the determination of validity and assign the appropriate null value codes if invalid. The process includes: • Conducting a common sense review of the data in context of previous time periods, such as the same season last year at the same site, when available, • Database reports for completeness and QC results are reviewed and filed, • Final determination of validity, with documented reasons for choice of invalidation codes (database logbook and validation report [attached] for each time period being reviewed).	• Assign null value codes to invalid data. • Add qualifiers to valid data if necessary. • Add comments that help explain validation rationale if necessary. • Initiate corrective action if necessary. • Final data validation package is assembled with network locations of supporting material, including relevant QC sheets, audit reports, etc.

ELEMENT 23 - VALIDATION AND VERIFICATION METHODS (D2)

23.1.1 - *Validation and Verification Methods*

This section describes how the Swinomish AQ Program verifies and validates data collection operations, following the sequence presented in Table 22-1. 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 HAPs from the refinery and quantifying health impacts. 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 validate the data will meet the DQOs.

The data verification and validation is conducted by the QA Reviewer and is reviewed by the AQSp, ECM and/or DDEP. Any identification of issues that require corrective action are logged in the form of memos to ECM or AQSp and corrective action 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.

23.1.2 - *Sampling Design*

The ambient air data is used to evaluate the adequacy of the sampling design, both site location and frequency/type of parameter data collection. By continuously reviewing the data and whether it is consistent with the objectives, the Swinomish AQ Program can determine whether monitors should be relocated, new analytical services purchased, or if other supporting information or (meteorological) monitors should be obtained. It can also be determined if other changes should be made to ensure the collected data represent the characterized population (air quality).

23.1.3 - *Data Collection Procedures*

The use of QC checks throughout the measurement process helps validate the activities occurring at each phase. The review of QC data such as the precision data, performance evaluations, and the equipment verification checks described in section 14 (B5) are used to confirm that the data collection procedures are in conformance with this QAPP and the objectives of the project.

23.1.4 - *Quality Control Procedures*

Validation of QC procedures will require a review of the documentation of corrective actions taken when QC checks failed to meet the acceptance criteria and the potential effect of the corrective actions on the validity of the routine data. Element 14 (B5) presents the limits that must be met by the QC checks and other QA activities. The review of these activities is conducted as part of the QA review process. It is expected that procedures will be refined over time and change with new methods and equipment. This is the opportunity to make recommendations for streamlining or improving the program. Recommendations for updating requirements, SOPs and this QAPP will be made at this time in the form of official communications to management.

23.1.5 - *Data Reduction and Processing*

The following QC functions are incorporated into our procedures to ensure quality of data entry and data management:

- Verification of Data Entry - As discussed in Element 9 and 19, every data entry operation (for example, one sample results) is double checked by the AQT or AQSp before the next data entry function is started.
    - At the beginning of the program every item of information entered into the database (such as every value transferred from eLogbooks) is verified to be correct after data entry by the QA Reviewer.
    - After no errors are found in 3 consecutive data entry processes, then data verification will be reduced to double checking at least one sample data entry process every quarter.
        - Any discrepancies are immediately documented and corrected in emails to the Air Program Director.
        - If there are more than two data entry errors found in any two sample results, this will be documented in an official email to management and 100% of all hand entered data will be verified since the last quarterly check.
            - This consists of completing the QAQC Checklist for Discrete Sampling of VOCs attached in Element 33.
    - eLogbook notes on Sample collection or Database entry will be completely checked by until at least ten consecutive entries checked and all data in the database are found to be accurate.
- Internal Consistency and Other Reasonableness Checks - Several other internal consistency checks are made by the person reviewing the data. For example, the end time of a data set must be greater than the start time. Additional consistency and other checks are implemented as the result of problems encountered during data screening.

Data Retention - Raw data sheets are retained as an electronic file on the SITC2 Network indefinitely.

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 (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 there be resources assigned to more 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 meet 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 7-2 and (more detailed) in Table 14-1, Table 14-2, and Table 14-3. 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 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:

- If there is more information on health impacts that can be used to modify our action limits. For example, the MRLs from the CDC are changed, 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 whether there is a new monitoring instrument available preferable to the method currently used, if US EPA guidance has changed, if there is heightened community interest, if there are nearby air monitoring agencies who can assist with independent assessments, data review, etc. For example, do we want to expand sampling methods to include TO-11 to gather concentrations of aldehydes?

Other QA considerations include:

- Is there a preventable condition causing data to be unusable or lost?
- Were the quality control criteria (14-1 through 14-3) 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 - REFERENCES

US EPA. 2014 National Air Toxic Assessment Results. <https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results>.

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US EPA. TAD For The National Air Toxics Trends Stations Program - Revision 2. Research Triangle Park, NC, 2009.

ELEMENT 26 - ATTACHMENT: ALS SOP FOR PERFORMING METHOD DETECTION LIMIT STUDIES AND ESTABLISHING LIMITS OF DETECTION AND QUANTITATION

ELEMENT 27 - ATTACHMENT: TRAINING LOG

ELEMENT 28 - ATTACHMENT: ALS SOP FOR TRAINING POLICY

ELEMENT 29 - ATTACHMENT: ALS ACCREDITATION IN WA STATE

ELEMENT 30 - ATTACHMENT: ALS SOP FOR LABORATORY ETHICS AND DATA INTEGRITY

ELEMENT 31 - ATTACHMENT: SOP FOR LABARCHIVES ELOGBOOKS

ELEMENT 32 - ATTACHMENT: EXAMPLE TO-15 DATABASE

ELEMENT 33 - ATTACHMENT: QUALITY ASSURANCE AND QUALITY CONTROL CHECKLIST TEMPLATE

ELEMENT 34 - ATTACHMENT: SAMPLING SCHEDULE TEMPLATE

ELEMENT 35 - ATTACHMENT: SOP FOR AIR SAMPLE COLLECTION WITH 6L CANISTER FOR TO-15 ANALYSIS

ELEMENT 36 - ATTACHMENT: FORECAST CHECKLIST TEMPLATE

ELEMENT 37 - ATTACHMENT: ALS CANISTER SAMPLING INSTRUCTIONS

ELEMENT 38 - ATTACHMENT: CLEANING AND CERTIFICATION OF SUMMA CANISTERS

ELEMENT 39 - ATTACHMENT: FLOW CONTROLLERS AND CRITICAL ORIFICES

ELEMENT 40 - ATTACHMENT: SITC COVID-19 SOCIAL DISTANCING POLICY

ELEMENT 41 - ATTACHMENT: ALS SOP FOR LABORATORY STORAGE ANANLYSIS AND TRACKING

ELEMENT 42 - ATTACHMENT: ALS SOP FOR DETERMINATION OF VOLATILE ORGANIC COMPOUNDS IN AIR SAMPLES COLLECTED IN SPECIALLY PREPARED CANISTERS AND GAS COLLECTION BAGS BY GAS CHROMATOGRAPHY / MASS SPECTROSCOPY (GC/MS)

ELEMENT 43 - ATTACHMENT: ALS SOP FOR EVALUATION AND PRESSURIZATION OF SPECIALLY PREPARED STAINLESS STEEL CANISTER

ELEMENT 44 - ATTACHMENT: ALS SOP FOR MANUAL INTEGRATION

ELEMENT 45 - ATTACHMENT: ALS QA MANUAL

ELEMENT 46 - ATTACHMENT: PERFORMANCE EVALUATION TEMPLATE

ELEMENT 47 - ATTACHMENT: FINAL DATA VALIDATION REPORT TEMPLATE