**PM2.5 Chemical Speciation Network (CSN) Field Sampling Quality Assurance Project Plan (QAPP)**

**Version 1.0**

**<Date>**

**<Monitoring Organization Name>**

**<Monitoring Organization Address>**

**<Period of Performance>**

**<Grant Number>**

# Project Management and Data Quality Objectives

## A2. Approval Page

**<Monitoring Organization>**

|  |  |  |
| --- | --- | --- |
| <Technical Representative>  <Name> | Signature:  Date: | <signature><date> |
| <Quality Assurance Officer>  <Name> | Signature:  Date: | <signature><date> |

**EPA Regional Office Approval**

|  |  |  |
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## Revision History

|  |  |  |
| --- | --- | --- |
| **Date** | **Version #** | **Description of Revision & Comments** |
| <Date> | <1.0> | <Initial Draft> |
|  |  |  |

## A4. Background and Problem Definition

This QAPP was generated using the U.S. Environmental Protection Agency (EPA) Quality Assurance Project Plan (QAPP) template, *PM2.5 Chemical Speciation Network Field Sampling QAPP Version 2.0*, which adheres to the current QAPP standard described in *EPA Directive No. CIO 2105-S-02* (U.S. EPA, 2024)*.* This QAPP is specific to field operations and incorporates by reference the QAPPs used by the filter handling laboratory (FHL) and analytical support laboratory (ASL), see Section A5.3.

<Monitoring Organization> will review this QAPP annually and, during the annual review, will check the CSN AMTIC site (<https://www.epa.gov/amtic/chemical-speciation-network-field-qapps-and-sops>) for revisions to the QAPP template and consult with the EPA Regional representatives when the template is revised.

### A4.1 Background

In 2000 the EPA and state, local, and Tribal (SLTs) monitoring organizations implemented the CSN to better understand the components of fine particles at selected largely urban locations across the country (U.S. EPA, 1999a). The CSN was first piloted at 13 sites across the U.S., and after the pilot phase, the program continued with deployment of the Speciation Trends Network (STN) in the fall of 2000. The CSN ultimately grew to 54 trends sites and peaked in operation in 2005 with 252 stations (54 trends sites and nearly 200 supplemental sites). The original CSN program had multiple sampler configurations including the Thermo Andersen RAAS, Met One SASS/SuperSASS, and URG MASS. During the first decade of the 2000s, EPA and SLTs worked to align the network to one common model of sampler for elements and ions, which was the Met One SASS/SuperSASS. In 2005, the Clean Air Science Advisory Committee (CASAC) provided recommendations to the EPA for making changes to the CSN which were intended to improve data comparability with the rural Interagency Monitoring of PROtected Visual Environments (IMPROVE) carbon concentration data. To accomplish this, the EPA replaced the existing carbon channel sampling and analysis methods with the URG 3000N and the IMPROVE\_A analysis method. Implementation of the URG 3000N sampler and IMPROVE\_A analysis method was broken into three phases starting in May of 2007 through October of 2009.

The CSN supported by the national contract laboratory currently consists of a core set of 52 speciation trends sites called the STN, and 86 supplemental sites for a total of about 140 CSN sites. Supplemental CSN sites are intended to support State Implementation Plan (SIP) development and other SLT monitoring objectives. Of the CSN sites, 76 are comprised of either the STN and/or NCore sites. NCore is a multipollutant network measuring particles, gases, and basic meteorology that has been in formal operation since January 1, 2011. The NCore network includes a total of 78 stations of which 66 are part of the CSN in urban or suburban stations, designed to provide representative population exposure. Another 12 rural NCore stations, designed to provide background and transport information, are part of the IMPROVE network. Both the STN and NCore are long-term networks intended to remain in operation indefinitely. The CSN measurements at NCore, STN, and IMPROVE sites are collected every third day. Supplemental CSN stations that are not part of NCore typically operate every sixth day.

More information on the CSN monitoring network, site-specific design considerations, and measuring and reporting of air quality data can be found in [40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58). Appendix D of Part 58 describes network design criteria, and Appendix E of Part 58 details siting criteria of samplers.

### A4.2 Problem Definition

The CSN is a complementary network to the national PM2.5 mass monitoring network, which has a goal of measuring ambient PM2.5 concentrations to compare against the PM2.5 National Ambient Air Quality Standard (NAAQS). CSN data are not used directly for attainment or nonattainment decisions related to PM2.5 mass. The major programmatic objectives of the CSN network are to provide:

* annual and seasonal spatial characterization of the PM2.5;
* air quality trends information for analysis and tracking the progress of SIP control programs; and
* data to assist in development of emission control strategies.

Primary stakeholders in the CSN are the decision-makers of SLT monitoring organizations, who use the data as input to models and for development of emission control strategies and determination of the strategies’ long-term effectiveness. Secondary stakeholders include EPA analysts who may use CSN data to determine trends of PM2.5 chemical species over time, relate the data to health effects, and to develop and evaluate air quality models. Other users may be public health officials and epidemiological researchers.

## A5. Project Description

This section provides a summary of the work to be performed, work products generated, and the schedule for program execution, including acquiring samples; performing chemical analysis; carrying out QA and quality control (QC) procedures to achieve data quality goals; and meeting the schedules for continued network implementation, operation, and data reporting.

### A5.1 Description

#### A5.1.1 Overview of CSN Operations

The operation of the CSN involves a series of field and laboratory activities. Figure A5-1 depicts eight stages incorporating the life cycle of a CSN filter from purchase through final data reporting. EPA’s national contract laboratories provide the FHL, ASL, and Data Validation Laboratory (DVL) support.

Figure A5-1. CSN Tasks and Responsibilities

### A5.2 Field Activities

For field activities there are two key areas of focus:

* ensuring the sampler operates on the correct sampling day at the correct flow rate with little variability; and
* minimizing sample contamination.

Table A5.1 lists critical field measurement parameters for the CSN and the associated measurement method.

Table A5.1 Critical Field Measurements in the CSN

| Measurement Parameter | Measurement Method |
| --- | --- |
| Temperature, ambient (°C) | Sampler’s temperature sensor |
| Ambient Pressure, atmospheric (mmHg) | Sampler’s pressure sensor |
| Date and elapsed sample time (yyyymmdd hh) | Sampler’s clock and timer |
| Flow rate, sampler (local L/min)\*\* | Sampler’s flow rate sensor |
| Total volume sampled (local m3) | Sampler’s calculated volume |
| Flow Rate Coefficient of Variation (CV) in percent | Sampler’s calculated flow rate CV |
| Free-form notes on sampling difficulties and unusual conditions at the site | Recorded in the on-site field sampling notebook and the comments section of the FSCOC. |

\*\* Flow rates are measured by samplers over 15-minute periods and are averaged for 24-hour events.

Table A5.2 lists the site operator activities and the required frequencies for the CSN.

**Table A5.2 CSN Site Operator Field Activities**

| Activity | Frequency | Comment or Reference |
| --- | --- | --- |
| Be trained via materials provided on the AMTIC website or other means. | Once, prior to site operation. Updated training as required. | Section A11 |
| Equipment (sampler, calibration, or verification devices, etc.) receipt, inspection, inventory, and operability checkout. Maintain spare parts inventory. | Once, initially, and whenever new or replacement parts are acquired. | Section B5 |
| Installation of sampler(s) at site. If site is moved, removal and reinstallation of sampler at updated location. | Once, at beginning of CSN participation. Repeat if site is moved or closed. | Section B1 |
| Sampler calibrations. | Prior to first sampling event; annually thereafter or whenever out-of-tolerance checks occur that cannot be corrected; following repairs affecting flow rate. | Section B5 |
| QC checks of sampler operation, including checks of time and date display, leaks, ambient and interior temperature sensors, pressure sensor, and flow rate. | Check dependent | Table B4-1 |
| Sampler operation, preventive maintenance, and cleanliness. Installation of sampling modules, programming sampler start/end times, and documenting field activities in site logbook and/or on FSCOCs. | NCore and Trends sites every 3rd day with dates and start/end times specified by EPA. Some non-trends CSN sites sample every 3rd day and others every 6th day. | Section B3 and B5 |
| Retrieval and packaging of sampled filter modules into shipment container. Completion of FSCOCs, and shipment of sampled filter modules to the FHL via express service. | Per frequency specified in the CSN shipping and sampling calendar | Section B3 |
| (1) Record sampling parameters, (2) retrieve data memory card for the URG. | At time of each filter retrieval or as soon thereafter as practicable. | Section B3 |
| Participate in data validation as needed. Review initial data from laboratory; conduct levels 2 and 3 data validation†. Inform CSN Regional Representative and the lab services program manager of data issues. | Initial training. Follow-up sessions. Monthly review of data sets as needed. | N/A |
| Communicate with monitoring organization management, CSN management, Network Contract Labs, and CSN Regional Representative. | As required and appropriate. | N/A |
| Participate in scheduled CSN QA activities (for example, on-site and field office inspections, handling of special QA samples, installation and periodic operation of a collocated sampler and special studies). | As scheduled by Monitoring Organization’s QA program, EPA OAQPS, or EPA Regional QA Officers. | Section C1 |

† The FHL conducts a level 0 and level 1 validation, but the field operators participate by accurately entering data on the FSCOC and reviewing recorded data to ensure there are no transcription errors. Field operators participate in level 2 and 3 validations when the monitoring organization data validation reviewers inquire about specific sampling results and associated meta data.

### A5.3 Laboratory Activities

CSN contract laboratories perform analysis of routine samples from the network. The following subsections and figures summarize the laboratory activities that support the CSN. Details for the FHL and ASL activities are included in the laboratory QAPPs (FHL 2023 and ASL 2023).

#### A5.3.1 Pre-sampling Activities

1. **(FHL) -** Polytetrafluoroethylene (PTFE) Teflon®, nylon, and quartz filters are received from various vendors and examined for integrity and background analyte concentrations.

2. **(FHL) -** Filters (or their containers) are assigned unique identifiers to allow tracking and accurate data entry.

3. **(FHL) -** Filters are conditioned, tested, equilibrated, and weighed if required and stored awaiting use.

4. **(FHL) -** Filters are packaged in filter holders or sampling modules specific to the type of sampler to be used at the field site.

5. **(FHL) -** The laboratory maintains shipping and sample collection supplies that include shipment containers and FSCOCs.

6. **(FHL) -** Assembled sampling modules including denuders are logged in to the database management system and then shipped to sampling sites on a pre-determined schedule.

#### A5.3.2 Post-sampling Activities

1. **(FHL) -** Shipments of sampling modules containing sampled filters are received in the laboratory, checked for integrity (damage, shipment temperature, etc.), and logged in to the database management system. Information on the FSCOC is reviewed. Filters are post-weighed if needed and shipped to the ASL.

2. **(ASL) -** Filters are placed in labeled containers which are stored (refrigerated as appropriate) until ready for chemical analysis.

3. **(ASL) -** Analysis results are entered into the laboratory database.

4. **(ASL) -** Collected sample volume is entered into the data entry system for calculating in-air concentrations of chemical species (µg/m3).

5. **(ASL) -** Filters are archived for the duration of the laboratory support contract. If the contract is renewed with the existing laboratory, the filters will stay archived at the incumbent laboratory. If the contract is awarded to a new contractor, then all archived filters will be transferred to the new laboratory for storage.

6. **(ASL) -** Filter extracts are archived (refrigerated) for 6 months or longer if requested.

7. **(DVL) -** Data are electronically posted for <the titles of the designated monitoring organization data validation contacts> to examine and validate.

8. **(ASL) -** Following review and approval by the <Monitoring Organization>, the data are uploaded to the Air Quality System (AQS) per the reporting schedule defined in the laboratory contract and at 40 CFR Part 58.16(d).

9. **(ASL) -** Sample collection and analysis data, including FSCOCs, raw analysis data (e.g., chromatograms, thermograms, and analyzer data reports), results of QA/QC activities, and notes, are filed for ready retrieval and inspection as required for a minimum of five years.

## A6. Quality Objectives for Measurement Data

The primary CSN Data Quality Objective (DQO) goal for STN sites is to detect a ±5% annual trend (decreasing or increasing) with a statistical power of 0.8 in the concentration of any of the target species (elements, ions, and carbon) within a 5-year period. Information related to how the CSN’s DQO was established may be found in the Chemical Speciation DQO Workgroup’s report (U.S. EPA, 1998). See Table B4.1 for sampler-based measurement quality objectives (MQOs).

## A7. Distribution List

This QAPP will be distributed to the staff presented in Table A7.1. Additionally, this QAPP will be provided to any unlisted staff who are assigned to perform work under this project.

Table A7.1 QAPP Distribution List

|  |  |  |
| --- | --- | --- |
| **Name** | **Organization** | **Role** |
| <EPA Regional Office QAM/QAMD> | US EPA, Region <X> | EPA Quality Assurance Manager or Delegate |
| <EPA Regional Office Technical Lead> | US EPA, Region <X> | EPA Regional Office CSN Representative |
| <Network Lead> | <Monitoring Organization> | <Org. Position Title> |
| <QA Lead> | <Monitoring Organization> | <Org. Position Title> |
| <Technical Staff 1> | <Monitoring Organization> | <Org. Position Title> |
| <Technical Staff 2> | <Monitoring Organization> | <Org. Position Title> |
| <Technical Staff 3> | <Monitoring Organization> | <Org. Position Title> |

## A8. Project/Task Organization

This section of the QAPP discusses the names, titles, roles and responsibilities of all key personnel in the project.

### A8.1 EPA Organizations

#### A8.1.1 OAQPS Ambient Air Monitoring Group (AAMG)

The AAMG in OAQPS is ultimately responsible for execution of the CSN and for the quality of reported speciation data. Broadly, the CSN Program Manager (PM) and QA Lead (QAL) provide guidance and oversight for the development of the quality system; they oversee the periodic review and revision of the QAPP template (Section A4); and perform and/or coordinate budgetary and technical planning activities with the Regions and SLTs. They specifically support CSN field operations by:

* coordinating and overseeing sample collection at CSN sites;
* working with the CSN Regional Representatives and SLT monitoring organizations to determine optimal sampling locations;
* providing a national contract for one (or more) laboratories to support the field site sample collection and provide filter analysis, initial data validation, data entry, and associated functions;
* coordinating the development of documents for the CSN, including standard operating procedures (SOPs) for field activities and laboratory operations, laboratory QAPPs, and the field sampling QAPP template;
* ensuring the success of the network by coordinating QA oversight activities such as technical systems audits (TSAs) of contract laboratories that support CSN.

#### A8.1.1.1 The CSN QA Lead (QAL)

The CSN QAL is responsible for implementing, reviewing, and improving the CSN quality and will:

* review, update, and approve OAQPS and CSN contract laboratories QAPPs, and coordinate their approval with other agencies, as needed;
* provide speciation laboratory QA support to SLTs and CSN contract laboratories;
* coordinate with OAQPS, the EPA Regional QA contacts, and others to ensure that periodic audits of field and laboratory activities are conducted, completed, and reported;
* oversee TSAs of CSN contract laboratories;
* manage the execution of the Mega Performance Evaluation (PE) program; and
* communicate QA issues to the CSN Program Manager, Laboratory Contract Project Officer (PO), and the CSN Regional Representatives.

#### A8.1.1.2 The CSN Program Manager (PM)

The OAQPS CSN PM responsibilities include:

* communicating with the EPA PO and EPA QA personnel on issues related to routine sampling and QA activities;
* understanding EPA monitoring and QA requirements and guidance and ensuring all key personnel correctly execute technical activities;
* developing budgets and providing program costs necessary to support the CSN;
* providing feedback on site relocations and removal;
* facilitating Administrator approval for changes to STN sites locations and operations; and
* recommending management-level corrective actions.

#### A8.1.2 CSN Regional Representatives

The current list of CSN Regional Representatives can be found at: <https://www.epa.gov/amtic/chemical-speciation-network-csn-general-information>. They are responsible for:

* maintaining and updating the contact list for CSN sites in their Region;
* informing OAQPS of requested site and/or sampling changes (frequency, location, special studies, etc.);
* assisting the Network Contract Laboratories with contacting site operators should questions arise regarding field operations;
* addressing technical questions from contractors or CSN site operators in their Region;
* distributing OAQPS communications (sampling schedule, technical notes, etc.); and
* ensuring that all personnel involved in data collection have access to needed training and are knowledgeable of QA requirements and procedures.

### A8.2 <Monitoring Organization>

SLTs are responsible for operation of CSN sites and for ensuring that sample data are validated for reporting to AQS. <Staff> at <Monitoring Organization> perform the following:

* receipt of filters from, and return shipment of collected filters to the FHL;
* collection of routine filter samples on the prescribed schedule and completion of the sampling Field Sampling Chain of Custody (FSCOC);
* purchase, receipt, acceptance testing, installation, verification, maintenance, and repair of air samplers, calibrators, and meteorological instruments;
* entering of flow verification and flow audit data into AQS;
* communicating with the Data Validation Laboratory (DVL) and Analytical Support laboratory (ASL) during monthly data validation through the Data Analysis and Reporting Tool (DART) or via e-mail to [CSNsupport@sonomatech.org](mailto:CSNsupport@sonomatech.org);
* communication with OAQPS and CSN Regional Representative when technical/quality assistance is needed;
* communication with CSN Regional Representative and/or FHL and ASL regarding issues concerning sample collection and field operations, as appropriate;
* participation in external QA activities such as TSAs and audits;
* site utility installations and site maintenance; and
* site operator hiring and training.

#### A8.2.1 QA/QC Organization for <Monitoring Organization> Field Site Operations

QA activities supporting CSN sites are arranged through the <QA Manager> at <Monitoring Organization>. The QA personnel are identified prior to field data collection and are assigned and organized to accomplish the following:

* implementation of the quality system for the CSN;
* review and adoption of the field QAPP;
* site inspections, instrument audits, and review of procedures to ensure specified QA/Quality Control (QC) checks are conducted and measurements systems are in control;
* issuance of corrective action memoranda and monitoring of follow-up actions from previous internal and external TSAs;
* participation in monthly validation of draft data sets received from the ASL; and
* arrangement for and participation in TSA activities requested by EPA Regional Offices.

### A8.3 CSN Network Contract Laboratory Support Activities

Details on these activities performed at the FHL, ASL, and DVL contract laboratories may be found in each of the laboratory QAPPs and associated SOPs (FHL 2023; ASL 2023, and the data validation resources at: <https://www.epa.gov/amtic/chemical-speciation-network-data-reporting-and-validation>). If analyses are performed at other SLT or contract laboratories, they must follow applicable laboratory QA requirements and are subject to audits by the EPA. Contract laboratory activities include:

* **Sample Handling (FHL) –** supplying each CSN site with necessary sampling supplies to include coated denuders, filter media, assembled sampling modules, shipping containers, and FSCOC forms.
* **Gravimetric Analysis (FHL) –** analysis forPM2.5 gravimetric mass determination by microbalance (performed for a small subset of CSN sites and SLT monitoring organizations).
* **Elemental Analysis (ASL) –** analysis for elements by energy-dispersive X-ray fluorescence (EDXRF).
* **Cations/Anions (FHL) –** analysis for cations and anions by ion chromatography (IC).
* **Carbon Species (ASL) –** analysis of elemental carbon/organic carbon (EC/OC) by thermal optical reflectance (TOR).
* **Optical Analysis (ASL) –** analysis for filter light absorption by Hybrid Integrating Plate/Sphere (HIPS) System.
* **Data Management (FHL, ASL, DVL) –** tracking sampling media components and managing data-related activities. This includes issuance of monthly data sets to <Monitoring Organization> for data validation in DART and review and entry of validated data into EPA’s AQS database.

## A9. Project Quality Assurance Manager Independence

The EPA CSN QA Lead works in the Ambient Air Monitoring Group. To ensure quality functions remain independent of all project work, the CSN QA Lead has direct reporting authority to the Group Leader and OAQPS QA Manager. The CSN QA Lead is not directly involved in CSN project operations and does not provide technical direction to the CSN contract laboratories. The CSN QA Lead will ensure that QA/QC issues identified through TSAs and data quality assessments are resolved. All EPA QA personnel will act independently from the environmental information operations. The CSN Program Manager will not have the authority to sign QAPPs for the QA Manager or designee, nor will the QA manager or designee have the authority to sign QAPPs for the CSN Program Manager. Additionally, the <QA manager/lead> in <Monitoring Organization following this QAPP> is independent from daily operation of the sites and network.

## A10. Project Organization Chart and Communications

This section details the roles and responsibilities and the lines of communication and reporting for the various agencies that conduct the CSN program. This information is summarized in Figures A10-1 and A10-2 and described below; names and contact information for staff at the various stakeholder organizations is given in Tables A10-1 and A10-2. EPA, the national contractor(s), and the <Monitoring Organization> are responsible for conducting environmental information collection. The national contractor(s) maintain QAPPs that are separate from this CSN Field Sampling QAPP (FHL 2023 and ASL 2023). When national communications are necessary, OAQPS will work with the Regional Offices and/or national contractors to communicate information to <Monitoring Organization>.

When a deviation or nonconformance of this approved QAPP occurs, the <Monitoring Organization> Program Manager and QA Manager will work together to evaluate its significance, the impact on the program, and the corrective action needed. If the severity of the nonconformance necessitates immediate action, the QA Manager will halt work, and the Program Manager will report the issue to the <Monitoring Organization> management. When work is halted, the <Monitoring Organization> notifies the EPA Regional Office Representative. See Section B1.1.4 for additional detail. <Modify the above text and describe any additional organization-specific communication pathways and procedures including timing of communication here.>

OAQPS

National Contract Oversight/  
Grant Distribution

Communication with laboratories and EPA Regional Offices

EPA Regions

Regional Oversight  
Coordinate Special Studies

Communication with SLT monitoring organizations

<Monitoring Organization>

Sample Collection  
Data Validation (L2/L3)

Communication within organization and with labs via data validation

Filter Handling Lab (FHL)

Distributes Sampling Materials  
Performs Select Gravimetric Analyses; Performs IC Analyses  
Data Validation (L0/L1)

Analytical Support Lab (ASL)

Carbon/EDXRF/HIPS Analyses  
Data Validation (L0/L1)  
Posts Data to AQS

Data Validation Lab (DVL)

Manages DART

Figure A10-1. CSN Project Organization

Table A10.1 Important CSN Contacts

|  |  |  |
| --- | --- | --- |
| **Role** | **Contact** | **E-mail** |
| EPA Laboratory Contract Project Officer (PO) | Jeff Yane | [yane.jeff@epa.gov](mailto:Yane.jeff@epa.gov) |
| EPA Program Manager (PM) | Melinda Beaver | [beaver.melinda@epa.gov](mailto:beaver.melinda@epa.gov) |
| EPA QA Lead (QAL) | Doug Jager | [jager.doug@epa.gov](mailto:noah.greg@epa.gov) |
| EPA CSN Regional Representatives | <https://www.epa.gov/amtic/chemical-speciation-network-csn-general-information> | |
| FHL Program Manager | Eric Poitras | [epoitras@rti.org](mailto:epoitras@rti.org) |
| ASL Program Manager | Sean Raffuse | [sraffuse@ucdavis.edu](mailto:sraffuse@ucdavis.edu) |
| DVL (DART) Program Manager | Jennifer DeWinter | [jdewinter@sonomatech.com](mailto:jdewinter@sonomatech.com) |
| EPA Air Quality System (AQS) | AQS Help Desk | [epacallcenter@epa.gov](mailto:epacallcenter@epa.gov) |
| Met One Instruments | Tim Morphy | [tim.morphy@acoem.com](mailto:tim.morphy@acoem.com) |
| University Research Glass (URG) Corporation | Julie Stone | [jmstone@urgcorp.com](mailto:jmstone@urgcorp.com) |

<Monitoring Organization>

Senior Management

<Monitoring Organization>

Program Manager

<Monitoring Organization>

Project Staff

<Monitoring Organization>

Quality Assurance Manager

Figure A10-2. <Monitoring Organization> CSN Project Organization

Table A10.2 CSN Contacts at < Monitoring Organization>

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Contact** | **Major Responsibilities** | **Email** |
| <SLT Position Title> | <SLT Senior Management> | <Brief description of job duties related to CSN> | <SLT Email> |
| <SLT Position Title> | <SLT QA Manager/Lead> | <Brief description of job duties related to CSN> | <SLT Email> |
| <SLT Position Title> | <SLT Program Manager> | <Brief description of job duties related to CSN> | <SLT Email> |
| <SLT Position Title> | <SLT Project Staff > | <Brief description of job duties related to CSN> | <SLT Email> |

## A11. Special Training Requirements/Certification

### A11.1 Training

This section describes any specialized training requirements necessary tocomplete the project, and the procedures are summarized to ensure that specifictraining skills can be verified, documented, and updated as necessary.

Each CSN monitoring organization must have minimum requirements for staff position experience, including a combination of education and previous employment experience. In addition to documented previous experience, each staff member shall be approved by management to conduct the activities for which they are responsible. It is the <Monitoring Organization>’s responsibility to assess the adequacy of their personnel's training and performance. Such approval shall be granted initially before beginning work and periodically thereafter. Each staff member shall have training documented and signed-off by management, which indicates the staff member’s training is current for each procedure performed. In addition to training documentation, records shall include items related to experience such as a resume or curriculum vitae, certificates from training coursework, and a job description specific to the <Monitoring Organization>.

#### A11.1.1 Field Operator Training

Site operators are trained in equipment operations, sample collection, sampler flow rate, temperature and pressure calibration checks, and documentation. Training materials and videos are available at: <https://www.epa.gov/amtic/chemical-speciation-network-training>.

Continued training is provided through updated memoranda, personal instruction during on-site systems and performance reviews, and information distributed by the OAQPS on AMTIC.

<Explain any additional required training as well as the procedure or system that will document training records and skill evaluation.>

### A11.2 Certification

There are no special certification requirements applicable to operation of the CSN samplers.

## A12. Field Operations Documentation and Records

This section defines the records critical to the field operations of the CSN, the information to be included on FSCOCs, documentation to be available for inspection, the reporting format, and document control procedures.

### A12.1 Information on Field Operations

#### A12.1.1 Site Information

The <Monitoring Organization> must maintain documentation regarding site characterization such as how and why the site was selected; identification of the representative scale of the site and the locations of nearby sources of particulate matter; site maps; latitude and longitude; sketches; and prints or digitized images of the site taken soon after installation of the speciation sampler(s). OAQPS, the CSN Regional Representative, or site auditor may ask for copies of this material.

#### A12.1.1.1 Annual Monitoring Network Plans

Annual monitoring network plans are annually due to EPA on July 1st. The annual monitoring network plan process provides an important communications and planning pathway between monitoring organizations, the EPA, and the public. The annual monitoring network plan provides documentation of the establishment and maintenance of an air quality surveillance system that consists of a network of monitoring stations that include NCore and CSN. The plan shall include a statement of whether the operation of each monitor meets the requirements of [40 CFR part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58). The annual monitoring network plans are provided by the <Monitoring Organization> for public inspection and comment at <insert SLT URL for monitoring plan location>. EPA maintains copies of SLT annual monitoring network plans at: <https://www.epa.gov/amtic/state-monitoring-agency-annual-air-monitoring-plans-and-network-assessments>.

#### A12.1.2 Field Operations Records

<Monitoring Organization> must maintain operational procedures and records including QAPPs, SOPs, field notebooks and communication, copies of FSCOCs, inspection and maintenance records, copies of system audits, and corrective action forms.

Any entry errors must be marked out with a single line and the correct information entered above this line. The operator must initial and date the strikeout to verify the accuracy and completeness of the modified entries.

The following types of notebooks or binders are to be used by field personnel to keep documents in order and readily accessible during a site system review:

*Field Notebooks—*Each field site operator will obtain hard-bound notebooks. The notebooks will be uniquely numbered and associated with the CSN program. Generally, all data from all routine field operations will be entered on FSCOCs or downloaded electronically from the sampler’s memory. The field notebook is used to record additional information about field operations, such as information regarding weather conditions and activities in the area that may influence the PM2.5 sample content and concentration (wind or electrical damage to equipment, construction or mowing activities in the area, welding, traffic). Such information should also be included in the comments section of the FSCOC so the FHL and ASL is made aware a sample may be compromised. Maintenance needs for the sampler and the platform should be documented and relayed to the site operator’s supervisor for consideration and action. In addition, the field operator may use this notebook to record important communications.

<Some organizations may have the capability of substituting the field notebook for electronic communications (i.e., electronic site notebooks). This is appropriate if it is used consistently and properly. For guidance on electronic notebooks, see Appendix J of the *Quality Assurance Handbook for Air Pollution Measurement Systems Vol II,* (U.S. EPA 2017a). Explain use of electronic logbooks, if applicable.>

*Field Binders*—A three-ring binder is a convenient repository for copies of the FSCOC forms and other appropriate data forms for routine operations, inspection and maintenance, systems audits and corrective actions, the field QAPP, SOPs, and updates or advisories received from EPA or from other management sectors.

#### A12.1.3 Electronic Sampler Data

Sampler run data from the URG 3000N shall be downloaded to a laptop/tablet computer or other electronic transfer device before the memory cards are shipped to the FHL with the filter cassette. The field site operator must retain a copy of the electronic data for sampler troubleshooting (if/as needed) and for later use during data validation. It is recommended that data be downloaded after each run; however, data from several runs may be accumulated in the sampler’s memory. Note that the sampler’s memory is finite, and operators should not accumulate more than two runs before downloading data from the sampler. Refer to the sampler operating manual for details. For the first-generation Met One SASS/SuperSASS, data are not downloadable and the FSCOC serves as the only record other than the data retained on the sampler’s internal memory. However, the most recent Met One SASS/SuperSASS provides a data download option via USB storage device. It is recommended that data be downloaded after each run following the sampler manual instructions.

#### A12.1.4 Field Sampling Chain of Custody (FSCOC) Forms

An example of the combined FSCOC and explanations of its content and use can be found in the FHL SOPs and in Figure B3-1. Field operators must retain the bottom copy of the carbonless form for their records.

Information recorded on the FSCOC serves as a backup in case the data downloaded from the URG 3000N sampler and more recent Met One sampler become corrupted or lost Difficulties with, or suggestions for improved operation of the samplers should be recorded on the FSCOC and in the field notebook. Information about significant events near the site that may affect the representativeness of the sample should also be entered on the FSCOC so the laboratory will be on alert for an unusual sample concentration data.

### A12.3 Flow Rate Documentation

EPA has developed the CSN Sampler Flow Rate Audit and Monthly Flow Check Worksheet (U.S. EPA 2024) which field site operators and auditors may use to capture the results from sampler performance verifications and audits. The forms (either electronic or hard copies) are completed and retained at <the monitoring organization office location> for five years. <If monitoring organizations choose to use a different form for documenting sampler flow rate audits and monthly flow checks, include the name and description of the form here and delete the opening sentence of this section. Attach the form as an appendix to this QAPP.>

### A12.4 Archival and Retrieval of Data

<Monitoring Organization> will retain all data records for a minimum of five years. <State where these data records will be stored>.

### A12.5 Document Control

This field sampling QAPP and SOPs are included in <Monitoring Organization> controlled document program. The documents have a revision/version history and <Monitoring Organization> will maintain a master list of all up-to-date, relevant guidance documents for staff to reference. The master list must include the version number and effective date for each quality systems document. When controlled documents are updated, the master list must be updated and all superseded versions (hard copy and electronic) must be collected and replaced with the new version to ensure consistency in the execution of procedures throughout the monitoring organization.

Any new or modified field procedures will require comparison against the established method before implementation. Any procedural changes must accomplish the established MQOs and DQO of the CSN.

# B. Implementing Environmental Information Operations

## B1. Sampling Process (Network) Design

An interactive map of all the current CSN sites can be accessed here: <https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors>. The network design components comply with the regulations specified in [40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Section 58.13, Appendices A, D and E. The NCore and other network components of the CSN have, for the most part, already been designed based on collaborative input from SLT monitoring organizations and other federal agencies. The final NCore network began operation January 1, 2011. More information is available at: <https://www.epa.gov/amtic/ncore-monitoring-network>.

### B1.1 Network Design

#### B1.1.1 Speciation Sampler Selection

The rationale for the design of the CSN originated in the monitoring regulations, promulgated at *Federal Register* (62 FR 38764), as part of the PM2.5 NAAQS review completed in 1997. Network design requirements stated in [40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Appendix D, Sections 4.7.1 and 4.7.4, provide guidance on locating monitoring sites for PM 2.5 with respect to scale and monitoring objectives. Site requirements for particulate matter monitoring with respect to roadways, sampler probe heights, and siting with other samplers are specified at [40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Appendix E.

#### B1.1.2 Establishment or relocation of a CSN sampling site

The installation of new or relocated CSN sampling sites will be completed in a timely manner to meet goals for data quality and timelines for data review and reporting. Per [40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Appendix D, relocation, closure, or addition of STN or NCore/CSN sites must be reviewed by the CSN Regional Representative and approved by OAQPS (delegated approval authority from the Administrator). Contact the CSN Program Lead for OAQPS review and approval. Notify the FHL, the CSN Program Lead, and the Regional CSN Representative if a supplemental site is to be closed or relocated.

Table B1-1 outlines the sequence of activities for bringing a CSN field site online.

Table B1.1 Sequence of Activities for Bringing a CSN Field Site Online

| Activity | Notes |
| --- | --- |
| Select sites. Arrange for space, electrical power, and personnel. | Ensure siting criteria are met. 40 CFR Part 58 Appendix E for siting requirements. |
| Order speciation sampler(s) and accessories. | Confer with EPA Regional Office and OAQPS prior to ordering to confirm sampler selection. |
| Acquire 10-m meteorological tower and sensor package, if appropriate. | Confer with EPA Regional Office prior to ordering.  Order only if needed at site(s). |
| Review CSN QAPP and pertinent SOPs. | Future updates to this QAPP and SOPs can be found at: <https://www.epa.gov/amtic/chemical-speciation-network-quality-assurance> |
| Receive and inventory sampler(s) and spare parts. | Confirm that all necessary sampling equipment and spare parts are received. |
| Finalize mechanism and schedule for delivery order process for routine, non-routine, and QA samples. | Confer with CSN Regional Representative. |
| Attend training sessions and/or review training videos. | Consult EPA Regional Offices and Section A11 of this QAPP. |
| Complete site preparation and sampler installation. Conduct safety and security checks. | Obtain site documentation and photographs/slides for site file. |
| Establish communications with the FHL to set date for first series of sample collections. | Request filters, data sheets, etc., from FHL. |
| As needed, conduct hands-on training at site. Collect one or more 24-hour test samples and complete data transcription and documentation. | Involve field staff, CSN Regional Representative, and CSN FHL as required. |
| Begin routine, every 3rd-day speciation sampling at CSN Trend and NCore sites and 1-in-6 days for other CSN sites as adopted by the monitoring organizations . | Refer to the shipping and sampling calendar provided by the FHL. |

#### B1.1.3 Collocation of Samplers

This section discusses the collocation of CSN samplers for precision estimates and with PM2.5 regulatory samplers or monitors.

##### B1.1.3.1 Collocation of CSN Samplers

Collocated CSN samplers provide speciation data from a separate but otherwise identical sampler, which can be used to estimate the precision of the total sample collection, handling, and analysis/data reporting process. Collocated samplers are operated every 6th day to coincide with the start and end times of the site’s primary sampler. Samples and data from the collocated sampler will be handled identically to those from the primary sampler.

There are six sites currently performing collocated CSN sampling: Bakersfield, CA; Riverside, CA; Roxbury, MA; Rutgers, NJ; G.T. Craig, OH; and Deer Park, TX. The site collocation is reviewed by EPA periodically to determine if rotating sites that are performing collocated sampling will provide a better representation of precision for the entire network. If changes are made, these changes will be described in a revised CSN Field QAPP template.

Data from the six collocated sites are used by EPA to calculate MQOs for precision. The MQOs are a CV of 10% for ions, 15% for carbon, and 20% for elements (U.S. EPA 1999b).

##### B1.1.3.2 Collocation with PM2.5 FRM/FEMs

The speciation samplers will be permanently installed within 1 to 4 meters of the site’s routine Federal Reference Method (FRM) or other samplers, if present ([40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Appendix A 3.2.3.4(c)). All NCore sites are required to have a PM2.5 FRM sampler present ([40 CFR Part 58](https://www.ecfr.gov/cgi-bin/text-idx?SID=62c96ab8dcc2ad5ffcb7ce5e333ab58c&mc=true&node=pt40.6.58), Appendix D 1.3(b)). STN and supplemental CSN sites should have either a filter-based or continuous PM2.5 sampler/analyzer present to provide a mass measurement for comparison with the speciation measurements because CSN does not provide PM2.5 mass measurements.

#### B1.1.4 Deviations from Approved Procedures

Because one of the major goals of the STN and CSN NCore sites is to determine trends in chemical speciation concentrations over time and within geographical areas, deviations from the established procedures and sampling schedule are allowed only after EPA OAQPS and the Regional CSN Representative’s approval. Should an occasional operational problem occur at a site, the site operator must note this in the field site notebook and on the FSCOC form that is sent to the FHL with the sample filters so the resulting data can be flagged. Unapproved, continued deviations from established sampling procedures at one or more sites will give rise to notifying the CSN Regional Representative and a review of the operating procedures, the personnel involved, and a request for prompt corrective action. Data acquired during periods when deviations from the established procedure occurred, or operational problems were encountered may be invalidated.

## B2. Sampling Methods Requirements

This section describes the procedures for collecting samples, and identifies the sampling methods and equipment, including sample preservation requirements. It also describes specific performance requirements, maximum sample pickup times, and actions to take when a failure in the sampling or measurement system occurs, who is responsible for corrective action, and how the corrective action will be documented.

The primary samplers in the CSN are the Met One SASS or SuperSASS for PTFE and nylon filters, and the URG 3000N for quartz filters.

### B2.1 Sample Preparation and Collection

#### B2.1.1 Preparation

Before a site visit, the operator must gather sampling modules containing the filters, data forms, and, if a sampler calibration check is scheduled, sampler verification equipment to check flow, temperature, and pressure. The sampling modules must be transported to the sites in a protected environment and not exposed to high temperatures.

#### B2.1.2 Field Sample Collection

The proper operation of the speciation samplers must be confirmed before the first run by following the testing and acceptance checklist in Section B5. At NCore and the STN sites, the samplers will run every 3rd day from midnight-to-midnight on **local standard time** for the entire year. The remaining CSN supplemental sites can be run on either every 3rd day or every 6th day schedule as established in the annual network plan. The sampling schedules are distributed annually by the FHL. Refer to Section A11.1.1 and B3 for details on setup and operation of the sampler, handling of filter sampling modules, hand-entry of data, and downloading of electronic files. Sampler QC check requirements are provided in Section B4.

The total volume of air collected by each speciation sampler will vary by sampler manufacturer and sampling channel. Samples are collected for 24 hours in duration and must not be less than 23 hours or more than 25 hours.

Field blanks are collected at a frequency of 1 per month at all CSN sites. The sampling schedule provided by the FHL will specify dates for the monthly collection. Any changes in collection frequency are made by the CSN Program Manager.

Should non-routine sampling be requested, the FHL and ASL will be notified by the CSN Program Manager. See Section B4.2.2 of this QAPP for more information on the sampling make-up policy.

#### B2.1.3 Sampler Recorded Measurements

Table B2.1 lists the information that is provided by the speciation samplers. This information is stored in the sampler’s memory and can be downloaded. Essential information will also be transcribed from the display screen of the sampler and hand-entered on the FSCOC as described in Section B3.

Table B2.1 Summary of Information Provided by the Speciation Sampler

| Information to be Provided | Units | Availability | | | Provided to AQS Database |
| --- | --- | --- | --- | --- | --- |
| Anytime | End of Period | Visual Display |
| Flow rate, average, for the sample period | L/min | \* (optional) | √ (required) | \* |  |
| Flow rate, CV, for the sample period | % | √ | √ | \* | √ |
| Flow rate, 5-min average out of specification (FLAG) |  | √ | √ | √ |  |
| Sample volume, total | m3 | √ | √ | √ | √ |
| Temperature, ambient, min, max, and average for the sample period | °C | √ | √ | √ | √  Average Temperature |
| Barometric pressure, ambient, min, max, average, for the sample period | mmHg | √ | √ | √ | √  Average Pressure |
| Filter temperature, differential, 30-sec interval, out of specification; Met One SASS/SuperSASS only (FLAG) |  | \* | √ | √ | Qualifier Flag |
| Date and time | yr/mo/d/h/min | √ |  | √ |  |
| Sample start and stop time settings | yr/mo/d/h/min | √ | √ | √ |  |
| Sample period start time | yr/mo/d/h/min |  | √ | √ |  |
| Elapsed sample time | h min | \* | √ | √ |  |
| Elapsed sample time out of specification (FLAG) |  |  | √ | √ | Null Code |
| Power interruptions ≤1 min, start time of first ten interruptions | h min | \* | √ | \* |  |
| User-entered information, such as sampler and site identification |  | √ | √ | √ | √ |

√ This information is required.

\* This information is optional. If information related to the entire sample period is optionally provided prior to the end of the sample period, the value provided should be the value calculated for the portion of the sampler period completed up to the time the information is provided.

#### B2.1.4 Sampling Module Transportation

The sampled sampling modules must be stored in a protective transport container and transported to the FHL according to the shipping and sampling calendar. Refer to Section B2.3.2 for details on sample retrieval time and temperature requirements.

#### B2.1.5 Field Maintenance and Calibration

The <Monitoring Organization> developed a maintenance schedule for field sampling equipment and verification devices. See Section B5 for more information. The <Monitoring Organization> consulted the operations manuals (URG 2010) and (Met One 2024 or Met One 2011), depending on which Met One controller (9805 or 9800) is used, and Section B5 for requirements and procedures for calibration of temperature and pressure sensors and the flow rates of sampling channels. <provide additional detail of the maintenance schedule implemented for the monitoring program.>

### B2.2 Sampling/Measurement System Corrective Action Process

Corrective action measures in field operations of the CSN will be taken to ensure the DQO is attained. Refer to the URG3000N and Met One SASS Operations Manuals for some of the common problems and the associated corrective actions associated with sampling. Procedures on data flagging and validation can be found in Section B7.2.3.

#### B2.2.1 Corrections to the QAPP or SOPs

The <Monitoring Organization> field site operators and their supervisors are responsible for implementing this field QAPP and are, in part, responsible for the quality of the data. If changes or corrections are suggested for the approved QAPP, personnel will notify the <Monitoring Organization> QA Manager. The <Monitoring Organization> QA Manager will review the proposed change and determine if revisions to the QAPP and/or SOPs are appropriate. The <Monitoring Organization> QA Manager will notify the CSN Regional Representative, and management regarding approval of any revisions to the documents. EPA CSN Regional Representatives will inform EPA OAQPS CSN program management and quality assurance leads of modifications that may affect the national consistency of sample collection. If new versions of the documents are created, the <Monitoring Organization> QA Manager will provide the CSN participants with instructions to discard the previous version.

### B2.3 Avoiding Sample Contamination; Temperature and Retrieval Time Requirements

This section details the requirements needed to prevent sample contamination, the sample temperature preservation requirements, and the permissible sample retrieval times. The CSN program does not have a defined, maximum holding time.

#### B2.3.1 Sample Contamination Prevention

To prevent sample contamination, powder-free anti-static gloves are worn while handling filter cassettes or sampling modules in the FHL. Once the sampling modules leave the FHL, they must not be opened due to the potential for filter damage or contamination. Sampling modules will be capped and protected in plastic sealable bags during shipment/transport to and from the site. When the sampling modules are removed from the sampler, they must be promptly capped and placed into the protective plastic bag to prevent contamination from dusts, gases, or abrasion. Site operators should wear clean disposable gloves when handling the sampling module.

#### B2.3.2 Temperature Preservation and Sample Retrieval Time Requirements

During shipment from the FHL to the sample location, there are no specific requirements for temperature control; however, the sampling modules returning from the sample location shall remain in their protective containers and inside the shipping/transport container. Excessive heat must be avoided after sample collection (e.g., do not leave in direct sunlight or a closed-up car during summer). During the sampling (24-hour) period, the filters will be subject to ambient temperatures and should not exceed the ambient temperature by more than 5°C for more than 30 minutes continuously. If this occurs in the SASS or SuperSASS, a sampler-generated flag is created, and it should be noted on the FSCOC (i.e., “X” qualifier should be marked on the COC). Note that the URG 3000N has one temperature probe, so the difference between filter and ambient temperature cannot be measured. Therefore, this sampling flag will not apply to the URG samples.

Sample filters collected by a single event sampler, or a sampler run in a single event mode on a 1-in-3 day sampling schedule should be retrieved and prepared for shipment to the FHL within 48 hours of the end of the sample period in order to prepare for the next 1-in-3 day sampling period. In some circumstances, this may not be practical or possible. The EPA also allows a 120-hour sample retrieval for filters used in a sampler that is operated on a 1-in-6 day or 1-in-3 day sequential schedule due to an inability to perform weekend or holiday retrievals. This applies to the first sampling event filter generated in the sequential two-event series. The second event filter is still subject to the normal 48-hour retrieval and shipping requirement.

After retrieval, once packaged for shipment, the sample shall be delivered to or picked up by the contracted courier service according to the shipping and sampling calendar. All CSN samples are shipped at ambient temperatures.

### B.2.4 Data Acquisition Requirements (Nondirect Measurements)

This section identifies the types of data needed for project implementation or decision making that are obtained from non-measurement sources such as computer databases, programs, literature files, and historical databases that support the CSN.

#### B2.4.1 Acquisition of Non-Direct Measurement Data

The CSN will generate most of the required data through FHL and ASL operations. Some data, however, may come from outside the network (e.g., meteorological data acquired from National Oceanic and Atmospheric Administration (NOAA) or National Weather Service (NWS) stations, or traffic flow data from transportation authorities.

#### B2.4.1.1 Sampler Operation and Manufacturers’ Literature

Manufacturers’ operating manuals and supplemental literature provide invaluable information for instrument operation and troubleshooting. Manuals for the speciation samplers, the devices used to verify a sampler’s proper operation (temperature sensors, pressure gauges, and flow meters) and calibration, data acquisition devices (laptop computers and the programs they contain), and all instrumentation used shall be readily available to site operators.

#### B2.4.1.2 Site Location Information

To select the best locations for chemical speciation sites (particularly new sites), the network designers rely on several external sources of information to minimize the collection of samples that are uncharacteristic of urban areas. Information about local emissions sources, for example, is reviewed to avoid locating a sampler too close to a particle source such as a major highway, or a dusty unpaved road. Information in <Monitoring Organization> databases could be appropriate, but this information needs to be spot-checked for accuracy by visiting the proposed site and surveying the immediate (within a 300-meter radius) area for potential sources of particulate emissions and other sources or air flow impediments that may not be recorded on older maps or in databases. Data regarding traffic load of nearby roadways may be obtained from the local department of transportation responsible for the geographic region. Such traffic data may not be available for recent periods and may not be available. In such instances, the <Monitoring Organization> might request a traffic study of the nearby roadways be conducted by the department of transportation or responsible entity. The meteorological characteristics near a site should be checked by reviewing several years of data from the nearest NOAA or NWS site to assess seasonal variations. In cases where the site is quite far from the nearest government weather station, it may be necessary to set up and operate meteorological sensors for wind speed and direction to characterize the micrometeorology of the location. If setting up and operating meteorological equipment and system is required, see U.S. EPA 2008 for guidance.

## B3. Integrity of Environmental Information (Sample Handling and Custody Requirements)

### B3.1 Introduction

This section describes sample handling and custody procedures that begin with placement of the filters in the sample collection modules at the FHL and extend through shipping the collected sample modules back to the FHL. These procedures are in place to ensure that:

* <The CSN site operator(s)> properly handle the sampling components from the time of receipt from the FHL until they are released for return to the FHL; and
* <field site(s)> document the proper information on the FSCOC.

Care must be taken when handling, storing, and transporting filters at all stages due to the following concerns:

* the small mass of particles collected on exposed filters;
* the potential for sample losses due to rough handling or sample volatilization; and
* the potential for weight gain due to contamination or uptake of reactive gases on the filter and particulate matter surfaces.

Sample handling procedures must be consistently followed to provide data that meet the DQO. Sample custody procedures are required to avoid misplacement of samples or confusion of one sample with another, and to provide documentation to assist in detection and resolution of FSCOC problems. A sample is in custody if it is in one’s actual physical possession or stored in a secured area restricted to authorized personnel. Sample handling and custody procedures are discussed below in the order in which each activity occurs.

### B3.2 Filter Handling and Custody Procedures Prior to Sampling Event

#### B3.2.1 Procedures in the CSN Filter Handling Laboratory

The FHL preloads the filter cassettes into the sampling modules, obviating any further filter contact by field operators.

Details on FHL handling of denuders and filters including loading of filters into sampling modules and packaging the components for shipment to the field office are given in the FHL’s SOPs and QAPP.

Each set of sampling modules and other equipment supplied by the FHL will be accompanied by a FSCOC. This form will contain the filter identification number, filter type, module or cassette identification number, and date by which the sampling media must be used. An example FSCOC is shown in Figure B3-1 and instructions for completion detailed in Table B3-1. The FHL completes the appropriate fields in parts A, B, and C of the form, retains a copy of the form, and transcribes the information into an electronic sample tracking system.

#### B3.2.2 Procedures at the Field Office

Upon receipt of sample modules at the field site, the CSN site operator must carry out the following documentation and handling steps:

1. Enter receipt of the shipment in the operator's field notebook, noting the date and time of receipt and any air bill or other tracking numbers associated with the shipment.
2. Inspect the exterior of the shipping container, note any evident damage, and record observations in the operator's field notebook.
3. Open the shipping container and ensure a FSCOC is present for each set of sampling components.
4. Ensure each identifying number printed on the FSCOC corresponds to an enclosed sampling channel component. Do not use any sampling component whose identifying bar code number is not listed on the FSCOC form. Notify the CSN FHL of any discrepancies.
5. Sign and date the custody record portion of the FSCOC form.

Store all components for a sampling event together in a container in a secure area for later transport to the site. Sampling components shall be stored and tracked so that the correct set of sampling components reaches the designated field collection site for use on the designated sampling day, according to the CSN shipping and sampling calendar.

Do not interchange sampler channel components intended for use with a particular speciation sampler at a particular site with components for any other sampler or site. The CSN FHL has labeled each sampler channel component for use at a particular site. Should an interchange occur, the CSN site operator must fully document the variance and inform the FHL so the analytical results can be associated with the correct sampler and site. The <Monitoring Organization> QA Manager should specifically check for correct sampler-result association when prompted to validate data in DART.

### B3.3 Sample Handling and Custody Procedures for Collection of Samples

The following procedures are brief descriptions from the SOPs and sampler operations manual. For more detailed information about the process of removing sampling modules, completing FSCOCs, downloading electronic sampler data, and packaging samples for shipment, refer to the SOPs in the References section of this QAPP and to the sampler’s operation manual.

#### B3.3.1 Installation of Filters

Sampling modules must be used at the field collection site on the sampling date specified on the FSCOC. Unused sampling modules should remain sealed or capped and kept from exposure to ambient air, temperature extremes, or vibrations.

Upon arrival at the site to set up a sampling event, the CSN site operator will install sampling modules and program the sampler following the sampler’s operation manual and specific SOPs. There are QC procedures that must take place at prescribed frequencies which may coincide with the installation of the sampling filters. Examples include flow rate checks, temperature probe and pressure sensor checks. These will be documented on the appropriate reporting forms. If a problem is discovered, the operator will take whatever steps are necessary to initiate the <Monitoring Organization>’s corrective action plan.

Once the sampling modules are installed at the site and the sampler is programmed to begin operation, the operator should complete the appropriate sections of the FSCOC.

#### B3.3.2 Post-sampling Procedures at the Field Collection Site

At the end of a sampling period, the operator must complete the following:

1. Transcribe the sampler data as indicated in Section E of the FSCOC and double-check that the transcription is accurate. Double-check all entries against the sampler display. Operators should print clearly and be sure the entries show clearly on the bottom page of the carbonless form. Refer to examples of the FSCOC in Figure B3-1 and to Table B3-1 for details. A separate FSCOC is associated with field blanks (Figure B4-5).
2. Remove the sampling modules from the samplers. Briefly examine them for damage and ensure that the correct module was retrieved from the correct sampling channel.
3. Cap the sampling modules and seal them in the protective bags. Place all sampling materials in the shipping/transport container.
4. Download the electronic sample collection data from the sampler following the manufacturer instructions. Remove memory card from URG sampler.
5. Unless performed at the monitoring site, return to the field office to complete packing and shipping arrangements.

Figure B3-1. Example Custody and Field Data Form

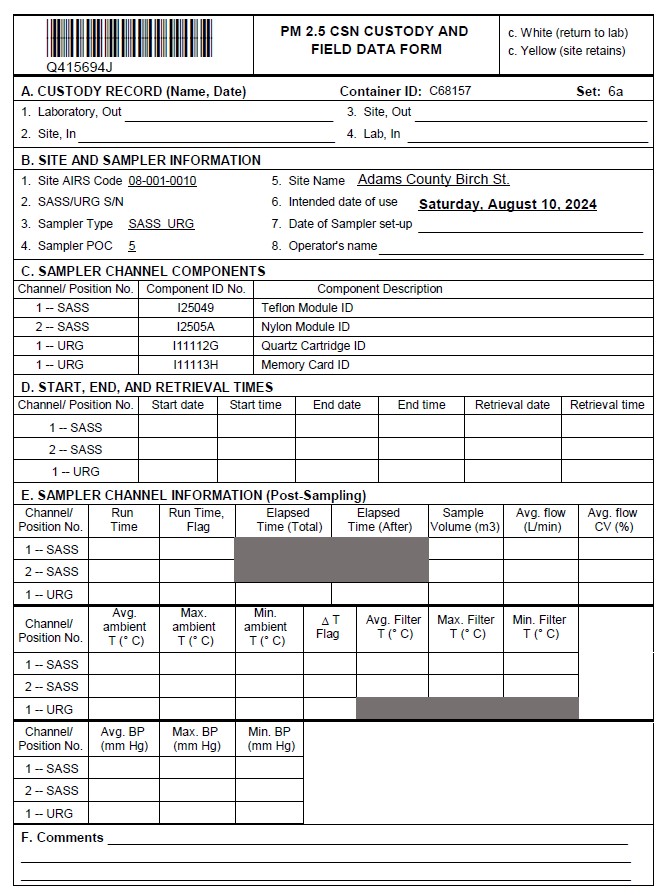


Table B3.1 Explanation of CSN Custody and Field Data Form

|  |  |
| --- | --- |
| **Section** | **Explanation of Section Contents** |
| Top of form | The custody/data form number will be unique to each sample set and assigned in advance by the FHL. The 2-part carbonless form will be distributed as follows:   * Top copy (white original) -- returned to the FHL * Second copy (yellow) -- retained by the field site office |
| A. Custody Record | Acknowledge receiving and relinquishing custody in this section. Persons should legibly sign their name and record the date. |
| B. Site and Sampler Information | Information about the site and the date the sampler modules are to be used. Most of this information will be pre-entered by the FHL. |
| C. Sampler Channel Components | This information will be entered by the FHL and is preprinted on the form. The sampling components needed for each sampler and its channel arrangement are listed here. The type of the sampler is identified. A separate FSCOC will be used for each set of sampling modules intended for routine sampling, field blanks, and special studies (as appropriate). |
| D. Start, End, and Retrieval Times | These entries are made by the site operator. The start and end times correspond to those programmed into the sampler during the setup phase. **The operator must enter these data clearly and must double-check the values against the sampler display screen.** The retrieval date and time indicate when the sampling modules were removed from the sampler. |
| E. Sampler Channel Information | The operator is responsible for making these entries at the site. Post-sampling information is transcribed directly from the display screen of the sampler. The sample volumes will be used by the ASL to compute analyte concentrations. The <Monitoring Organization> will use these data in levels 2 and 3 validations to identify problems with the sampler. Again, t**he operator must enter these data clearly and must double-check the values against the sampler display screen.** |
| F. Comments | The operator records additional notes as well as observations of unusual events. Recorded information should reference applicable sections of the form. Detailed information should also be recorded in the field notebook and referenced to the unique custody/data form number, location, sampler, and sampling date. |

#### B3.3.3 Post-sampling Shipping Procedures

Within 48 hours following the end of the sampling set for 1-in-3 day sampling (or within 120 hours after end of the first sampling period of a sequential or 1-in-6 day sample set), the CSN site operator will:

1. Retrieve the samples per Section B3.3.2,
2. Ensure all appropriate paperwork is complete, including custody “site, out” name and date,
3. Retain the second page of the two-part FSCOC and include the remaining copy in the shipping container,
4. Seal the FSCOC in a Ziplock plastic bag and tape the bag on the inside of the lid of the transport container,
5. Attach the pre-printed return label to the top of the shipping container, and
6. Transport the sealed container to a drop point or maintain the package for shipment back to the FHL by the contracted shipping company.

Deviations from the shipping and sampling calendar and other special circumstances should be discussed with the FHL.

#### B3.3.4 Procedures in the CSN FHL

The CSN FHL’s procedures for receiving, disassembling the sampling modules, and handling the filters and denuders are covered in the FHL QAPP and associated SOPs (FHL 2023).

### B3.4 Sample Archival

Collected filters and/or their extracts will be archived by the ASL according to the custody and handling procedures for inventorying and archiving these materials as described in the ASL’s QAPP (ASL 2023).

## B4. Quality Control Requirements

The following subsections detail the field QC activities, including sampler and procedural checks, and field blank procedures, all of which are used to help ensure CSN DQO is met. Other methods of ensuring QC, including instrument performance audits, are covered in Section C1 of this document.

### B4.1 Quality Control Checks

A verification is a QC check performed by the operator that compares the instrument’s current state of performance against a NIST-traceable reference standard to determine that the sampling instrument is operating within acceptable limits. If the verification check fails acceptance criteria, the operator should troubleshoot the instrument, perform recalibration (Section B5), and repeat the verification check to verify proper performance. Table B4-1 contains a complete list of QC checks, their required frequency, the associated acceptance criteria, and corrective action. The table is ordered by the recommended order of completion.

QC checks and their results shall be recorded in <the CSN Sampler Flow Audit and Monthly Flow Check Worksheet dedicated to this purpose (U.S. EPA 2024) or other monitoring organization form (Attach the form as an appendix to this QAPP)>. Operators are required to perform QC checks minimally every month and record the details of the verifications in the worksheet. The worksheet may be updated periodically.

<It is recommended that results of the QC checks be graphed to help track and visualize changes or drifts in sensor responses that will alert the site operator to the need for preventive maintenance, repair, or replacement of a speciation sampler. Delete the preceding sentence if the monitoring organization choose not to use it.> Detailed information on calibrations and instrument repairs must be recorded in the field notebook.

Table B4.1 CSN QC Checks

| Measurement | Frequency | Acceptance Criteria | Corrective Action |
| --- | --- | --- | --- |
| Temperature | Monthly | ± 2°C of a certified NIST-traceable transfer standard | Recalibrate the sensor; if recalibration fails, consult with the manufacturer for troubleshooting, repair, or replacement. Note, if recalibration is necessary, a flow calibration is needed. |
| Pressure | Monthly | ± 10 mmHg of a certified NIST-traceable transfer standard | Confirm that the pressure sensor is not in direct sunlight; recalibrate the sensor; if recalibration fails, consult with the manufacturer for troubleshooting, repair, or replacement. Note, if recalibration is necessary, a flow calibration is needed. |
| Average flow rate CV (a) | Review after every event | CV < 2% of set flow for URG and < 5% for Met One | Verify sampler flow rate. If the flow rate is low, recalibrate flow; if recalibration fails, consult with the manufacturer for troubleshooting, repair, or replacement if flow issues persist. |
| Flow rate check (b) | Monthly | ±5% sampler indicated and design flow vs. NIST-traceable standard | Remove the flow rate measurement adapter, reconnect and repeat flow rate check; perform a leak test; recalibrate flow; if recalibration fails, consult with the manufacturer for troubleshooting, repair, or replacement if flow issues persist. |
| Leak check | Monthly | Met One: ≤ 0.1 L/min  URG: ≤ 225 mmHg vacuum pressure loss for 35 seconds | Remove the leak check adapter, reconnect and repeat the leak test; inspect all seals, O-rings, and tubing for damage and replace as necessary. Consult with the manufacturer for troubleshooting, repair, or replacement if leak persists. |
| Clock/timer verification | Monthly | ≤ 1 min from standard time | Check programming; reset the clock. |

1. This QC check is a warning mechanism for abnormal or deteriorating sampler performance. The average flow CV is reported by the sampler at the end of every sampling event along with max/min temperatures and pressure. The Met One and the URG instruments calculate the CV from all polled data from the onset of the sampling event and the CV is recorded on the FSCOC and field data form.
2. The one-point flow rate check should be taken when sampler is supposed to be operating at its design flowrate (6.7 L/min in the case of the Met One SASS sampler, and 22.0 L/min for the URG3000N); a flow check greater than 5% different than either the indicated or design flow requires recalibration of the sampler; a flow check greater than ± 10% requires sampler recalibration and data invalidation back to the most recent passing flow check.

### B4.2 Flow Rate, Temperature, Barometric Pressure, and Completeness

The following discusses the QC indicator check calculations conducted during CSN field operations. Understanding how these calculations are performed allows users the ability to review the results. <Many of these calculations are performed automatically in the CSN Flow Rate Audit and Flow Rate Check QA/QC worksheet (U.S. EPA 2024) or explain organization spreadsheet/form.>

#### B4.2.1 Flow Rate, Temperature, and Barometric Pressure

The ability to separate PM2.5 from larger size particles is due to the inherent design of the separation device (whether a cyclone or impactor) in each sampler. The performance of the separation device is a function of the flow rate. Consequently, the ability of the sampler to maintain the designed flow rate is a critical performance parameter. The periodic measurement of the sampler’s actual flow rate by a NIST-traceable reference standard constitutes the most accepted procedure for measuring the accuracy of the sampler’s flow rate. A single flow check, however, only indicates the potential bias in sampler flow rate since the last valid flow check where the flow was within acceptance limits. Systematic bias of the sampler flow rate can only be established by a series of flow checks and calibrations. If the flow checks reveal that the flow rate varies above and below the calibration set point, then there is no systematic bias. If the flow checks reveal the flow rate consistently varies in one direction from the calibration set point, then there is a systematic bias. The flow rate should never fall outside of acceptance limits without a corrective action. A flow check will compare the measured reference flow versus the sampler indicated flow, and the measured reference flow versus design flow. The sampler indicated flow must be accurate because it will be used to calculate total sampled air volume, and the actual flow rate must be near the design flow to ensure the PM2.5 separator has a cut-point of 2.5 µm. Equations 1 and 2 should be used for single point flow rate checks:

Equation 1

Equation 2

where:

*d =* percentage difference for a sampler indicated flow check

*reference* = actual flow rate of sampler based on the measurement by a NIST-Traceable standard

*sampler =* the sampler indicated flow rate

*design flow =* the flow rate at which the sampler is designed to operate (i.e., 6.7 L/min for the SASS/SuperSASS and 22.0 L/min for the URG)

With respect to the CSN, Equation 1 applies to evaluation of flow rates, and not to Temperature (T) and Barometric Pressure (P). For T and P, agreement is expressed in terms of absolute differences in measurements (i.e., within ± 2ºC or ± 10 mmHg) against a NIST-traceable reference standard. As with flow rate, a single check or audit of temperature and/or pressure only indicates potential bias in a sampler since the most recent acceptable check. A series of checks/audits is required to establish whether systemic bias exists within the sampler. If, given a series of checks/audits, the measurement consistently exceeds acceptance limits in the same direction (either positive or negative), a systemic bias exists.

#### B4.2.2 Completeness

Samples and sample results may be invalidated for several reasons. In all cases, data are entered in AQS flagged with a null code indicating the data are invalid. To increase the likelihood of attaining the completeness MQO of ≥ 75%, “make-up” samples should be collected when a sample was not collected on the originally scheduled sample date.

Sampling modules are provided by the FHL to the <Monitoring Organization> operators prior to the scheduled sampling date. If a sample cannot be collected on the originally scheduled sample day, the sample should be collected as close to the original sampling date as possible, and before the next scheduled sampling date. If the sample cannot be collected before the next scheduled sampling date, send the sampling modules back to the FHL without sampling.

### B4.3 Field Blanks (FBs)

FBs provide an estimate of total measurement system contamination and are collected to evaluate the effects of field operations, shipping and transport, and handling. By comparing information from FHL and ASL blanks against the FBs, the amount of contamination due to field activities can be estimated. FBs, loaded in sampling cassettes/modules, for each type of filter will be sent from the FHL to accompany sample filters intended for sample collection. The field operator is to handle the FB sampling module just as he/she would a module to be exposed but without drawing flow through it. FBs are pre-loaded into the sampling cassette for the URG 3000N. FBs for the Met One SASS/SuperSASS are sent as separate modules that need to be loaded by the field operator onto one of the channels designated for FBs. The procedure for FB collection on the Met One is provided below.

#### 4.3.1 Field Blank Collection Procedure (Met One)

The FHL sends monthly FB canisters and FSCOC to each monitoring organization according to the established schedule. Currently, sequential 1-in-3 day sampling sites receive FBs (labeled 10QFB) with sample 9Q (nylon and Teflon™) and sites sampling on the 1-in-6 day schedule receive their FBs (labeled 7aFB) with one sample each month (nylon and Teflon™).

The FBs should be handled identically to routine samples and remain on the sampler for the same duration as routine samples; however, no air is drawn through the FB canisters.

**Procedure**

To prepare the SASS/SuperSASS sampler for FB collection and ensure no sample is drawn through the FB canisters:

1. Disconnect the sampling lines labeled 3 and 4 from the pump box.
2. Cap the end of these lines (see Figure B4-1).
3. Cap the corresponding ports on the pump box (see Figure B4-2).

Figure B4-1. Capped sampling lines



Figure B4-2. Capped ports on pump box



To collect FBs after installing the sampling canisters on channels 1 and 2:

1. Install the Teflon™ FB canister (labeled with a green dot) onto channel 3.
   1. Sample 7a for 1-in-6 frequency; or
   2. Sample 10Q for 1-in-3 frequency.
2. Install the nylon FB canister (labeled with a red dot) onto channel 4 (see Figure B4-3).
   1. Sample 7a for 1-in-6 frequency; or
   2. Sample 10Q for 1-in-3 frequency.
3. As an additional safeguard, program the sampler to only collect samples on channels 1 and 2 (See Figure B4-4).
4. Begin sampling as scheduled and document the FB sample collection and retrieval dates on the FB FSCOC (See Figure B4-5) when sampling is complete.

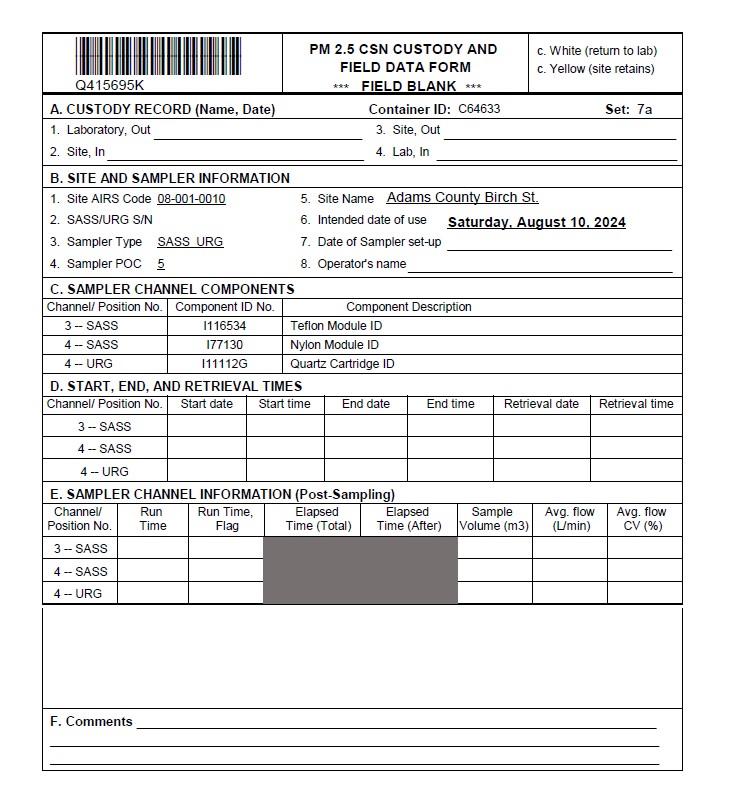
Figure B4-3. Sampling canisters on channels 1 and 2 and FBs on channels 3 and 4



Figure B4-4. Sampler programmed to collect samples on only channels 1 and 2



Figure B4-5. Example FSCOC for FBs.



**Note:** If channels 1 and/or 2 are inoperable and channels 3 and 4 are needed for sampling, reconnect channels 3 and 4 and follow the above instructions for channels 1 and 2 to use for FBs while utilizing channels 3 and 4 for sample collection. Perform leak check and flow verification after reconnecting a disconnected line.

## B5. Instrument Calibration, Testing, Inspection, and Maintenance

### B5.1 Overview

Verification is the comparison of a measurement standard or instrument with another reference standard, a reference material, or reference instrument to quantify and report, any difference or variation (deviation) from the reference value. The purpose of verification is to identify and correct bias; therefore, an instrument which fails verification conducted with an audit standard that is known to be accurate will need to be calibrated. Calibration involves the adjustment of the performing measurement device or instrument so that it measures and reports values that closely replicate those same values represented by standard reference materials or reference devices. For CSN samplers, calibration activities include certifying the calibration standard and/or transfer standard against an authoritative standard (usually those produced by National Institute of Standards and Technology [NIST] or reference standards certified to be a certain accuracy based on procedures developed by NIST).

Parameters of the CSN samplers that are subject to routine calibration checks in the field include the following:

* flow rate (all filter channels),
* ambient temperature (one per sampler),
* filter temperature (channel 1 in the SASS, all channels in the SuperSASS, no filter temperature probe in the URG 3000N), and
* barometric pressure (one per sampler).

Calibration should only be initiated when a QC parameter does not meet its acceptance criteria during verification performed with an audit standard that is known to be accurate. The CSN uses a two-tiered approach to calibration that involves the following:

* multipoint calibration initially and when there is a failure during a verification (QC check) or audit, and
* QC checks (Section B4) to ensure that calibration remains within the specified acceptance criteria.

Instrument adjustments that occur during multipoint calibrations are followed by a one-point QC check to double check operation of the transfer standard.

### B5.2 Calibration and Verification of Field Instrumentation

Prior to use, following receipt and installation of a CSN sampler, the temperature probes (ambient and filter) and barometer (single point), as well as the flow controller (multi-point) are calibrated. The site operator, thereafter, performs calibration checks and maintenance as required and detailed in the <Monitoring Organization> SOPs (attached as an appendix to this QAPP). The required checks and their associated frequency and acceptance criteria are detailed in Table B5-1.

The following verifications are performed in the field by the site operator:

**Time:** The sampler clock shall be set for local standard time and within ± 1 minute of a reference time (cellular phone, global positioning system, or similar accurate clock). If a cellular phone or similar device is not available, time can be set against an atomic clock that can be found on the internet: <https://www.time.gov/>.

**Temperature Probes:** The SASS sampler has an ambient temperature probe and a filter temperature probe on channel 1, while the SuperSASS has filter temperature probes on all channels. The URG 3000N has an ambient temperature probe, but no filter temperature probe. The CSN site operators will perform one-point field verifications of all sensors minimally every month using a digital NIST-traceable temperature probe.

**Barometric Pressure:** A NIST-traceable digital handheld barometer (e.g., BGI TetraCal, Alicat, etc.) will be used in the field for one-point check of the sampler’s barometric pressure sensor minimally every month.

**Flow Rate:** A one-point flow rate verification (Met One SASS/SuperSASS) or three-point flow rate verification (URG3000N) will be performed for each sampling stream using a NIST-traceable flow rate transfer standard minimally every month.

Calibration standards for the temperature, barometric pressure, and flow rate verifications and calibrations are given in Table B5-2. All calibration standards must be recertified annually and traceable to NIST. Recertification may be done by the standards’ manufacturer or by a third-party, accredited metrology laboratory. Records of all certifications must be maintained, including the identity of the NIST reference, the procedure used to establish traceability, and a certificate of traceability. Procedures for temperature, barometric pressure, and clock/timer calibrations should follow the manufacturer’s procedures. The Met One and URG samplers have different air sampling channels, each of which is used to sample onto a different filter type. Whenever possible, the individual flow rates should be calibrated independently of each other.

All verifications and calibrations, as well as sampler and calibration equipment maintenance, shall be documented in field data notebooks and annotated with appropriate flags. The records will normally be controlled by the CSN field operators, and they will be kept in the field offices or field collection sites when in use. Eventually, all calibration records shall be appropriately filed (see Section C2).

Table B5.1 Calibration, Maintenance, and Recertification of CSN Samplers

| Criteria | Acceptance  Criterion or advisory limits | Frequency |
| --- | --- | --- |
| ***Initial Installation Calibration and recalibrations thereafter*** | | |
| Temperature calibration | ±2°C of standard | On installation, then annually, or if verification/audit indicates drift or failure |
| Pressure calibration | ±10 mmHg | On installation, then annually, or if verification/audit indicates drift or failure |
| Multipoint flow rate calibration for URG only; Single point flow calibration for Met One | ±2% of transfer standard at each flow rate as a check of the calibration once calibration is successfully performed | On installation, then annually, or if verification/audit indicates drift or failure |
| ***Sampler Maintenance*** | | |
| Inlet/downtube cleaning | cleaned | Lesser of every 15 sampling events or every quarter |
| Filter chamber cleaning | cleaned | Monthly |
| Cyclone and manifold cleaning | cleaned | Approximately every 30 use days |
| Pump box air supply fan filter cleaning | cleaned/changed if present | Monthly |
| Manufacturer-recommended maintenance | Per manufacturer’s operating manual | Per manufacturer’s operating manual |

Refer to the URG 3000N and SASS/SuperSASS Met One SOPs and operation manuals for more information.

Table B5.2 Calibration Standards for CSN Samplers

| Transfer Standard | Acceptance  Criterion or advisory limits\* | Frequency |
| --- | --- | --- |
| Flow rate transfer standard | ±2% of NIST-traceable standard | Annually |
| Field thermometer (e.g., BGI TetraCal, Alicat) | ±0.1°C resolution, ±0.5°C of NIST-traceable standard | Annually |
| Field barometer (e.g., BGI TetraCal, Alicat) | ±1 mmHg resolution, ±5 mmHg of NIST-traceable standard | Annually |

\* Acceptance criteria taken from Section 4.2.2 of Quality Assurance Guidance Document 2.12 (U.S. EPA, 2016).

### B5.3 Sampler/Equipment, Testing, Inspection and Maintenance

This section discusses procedures to test, inspect, and maintain CSN samplers and the supporting equipment used at CSN sites.

#### B5.3.1 Testing and Acceptance Criteria

Upon sampler receipt, perform the required flow rate, temperature, and barometric pressure QC checks required in Table B5-1.

#### B5.3.2 Maintenance

Routine preventive maintenance shall be practiced in accordance with the “manufacturer’s instructions” given in the operation manuals and any maintenance bulletins or updates issued by the manufacturer. This section describes maintenance items for CSN field equipment. Preventative maintenance is increasingly important as sampling equipment in the CSN has been in operation for several years. Table B5.3 lists field items that require preventive maintenance and periodic recertification. Others may be added to this list as experience is gained.

Table B5.3 Preventive Maintenance and Recertification of CSN Field Equipment

| **Maintenance Item** | **Recommended Frequency** |
| --- | --- |
| **PM2.5 Speciation Samplers** | |
| 1. Check sampling inlets, and URG down tubes for insects, obstructions, and water intrusion. 2. Check O-rings on each filter cassette for wear, damage, and proper seal. 3. Check for water intrusion inside the sampling module. | Each visit to site |
| 1. Clean sampler inlet surfaces. 2. Clean the interior of the Sample and Controller Modules with lint-free wipes or paper towels to remove insects, dirt, or water deposits. 3. Examine O-rings and re-grease or replace as necessary. 4. Clean interior of sampler case (if applicable). 5. Replace denuders with freshly coated ones and return used denuder to laboratory for refurbishment. The FHL will handle this maintenance. 6. Inspect and service cooling air intake filter and fans. | Monthly |
| 1. Inspect O-rings. Apply very light coat of vacuum grease if required. 2. Check all vacuum tubing, vacuum lines, tube fittings, and other connections to pump and electrical components; replace if necessary. 3. Clean sampler downtube (unless it contains a denuder) and inlet surfaces. 4. Inspect and service water seal gasket at downtube entry to case if applicable. 5. Clean cyclones and manifolds upstream of sampler module. 6. Clean sampler inlet by pushing a slightly moistened paper towel with a wooden dowel through the inlet tube. Allow to dry before using inlet tube. 7. Rotate the quartz filter cassettes on the URG “AUDIT” cartridge for conducting verification and calibrations. Replace with a new cartridge containing clean filters. Rotate the clean filters to the number “1” position once a quarter or as needed. | Quarterly (every 3 months) |
| 1. Overhaul or replace sampling pump and solenoids. | As recommended by manufacturer |
| **Calibration and Check Devices** | |
| NIST-traceable flow rate transfer standard  1. Recertify vs. NIST standards.  2. Replace batteries (if applicable).  3. Visually check orifices for dust or breakage. | 1. Annually 2. As needed 3. Each use |
| NIST-traceable temperature transfer standards (digital thermometer)  1. Recertify vs. NIST standards.  2. Replace batteries.  3. Inspect probe tip and connecting cord. | 1. Annually 2. As needed 3. Each use |
| NIST-traceable pressure transfer standard  1. Recertify vs. NIST standards.  2. Replace batteries. | 1. Annually 2. As needed |

#### B5.3.3 Critical Spare Parts

Field operators shall maintain an inventory of critical spare parts (Table B5.4) at the field office to prevent sampler downtime or interruption.

Table B5.4 Critical Spare Parts

|  |  |
| --- | --- |
| Device | Spare Part |
| Speciation sampler | O-rings (specific to sampling unit) |
| Vacuum/pressure tubing and connecting compression or other types of fittings |
| Filter packs or cassettes (to be forwarded to the FHL) |
| Denuders (to be forwarded to the FHL) |
| Sampling lines/tubing (as applicable) |
| Fuses |
| Transfer standard for temperature, barometric pressure, and flow | Batteries |
| Temperature probe |
| Tubing |

## B6. Inspection/Acceptance for Supplies and Consumables

The inspection and acceptance procedures for the sample filters, sampling modules, denuders, and filter cassettes is covered in the FHL QAPP. For sampler and other field supplies, refer to the sampler Operation Manuals.

### B6.1 Acceptance Criteria

Newly received field equipment shall be inspected to ensure all parts are present and undamaged. If damage has occurred in shipping, the shipping agent and/or vendor will be notified. All new equipment for field use should carry a warranty for minimally 6 months from purchase, preferably one year or longer. Refurbished equipment shall also be inspected carefully and subjected to operational tests since the warranty on equipment may not be as comprehensive. Additional warranty periods may be available for purchase from the vendor.

Field operators shall periodically inspect NIST-traceable transfer standard equipment that is subject to wear and tear during use (for example, temperature, pressure, and flow rate check devices). Equipment shall be returned annually to the vendor or an appropriate metrology laboratory for cleaning, servicing, and recertification against NIST standards.

<Monitoring Organization> personnel shall use procurement logs for purchases of new equipment and consumables. These logs shall also indicate whether the items were accepted or rejected. In addition, the field personnel must keep an equipment inventory list for each piece of equipment and its warranty date.

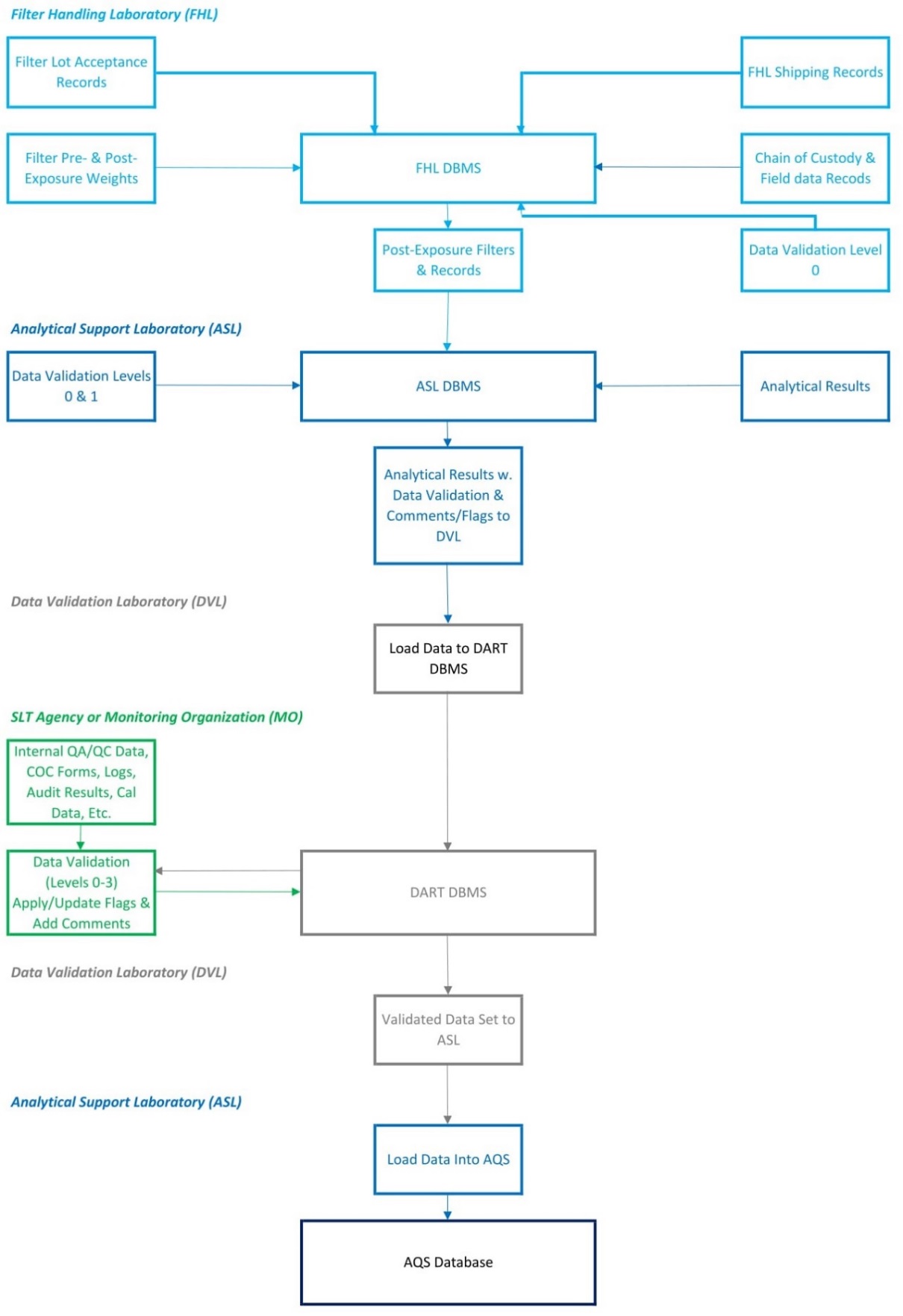
## B7. Environmental Information Management

This section presents information on how field data for the CSN will be managed. It does not address data sets obtained outside the network nor does it include management of data that may be given in summary and interpretive reports of special studies. The CSN sample concentration data will be loaded into AQS by the ASL. All flow audits and monthly flow verifications must be reported to AQS by the SLT monitoring organizations per 40 CFR 58.16.

Sample and QA/QC data for the CSN come from several sources at both the CSN FHL and ASL, as well as the <Monitoring Organization> that perform the field operations and data validation and review. The flow of data among organizations and data systems is illustrated in Figure B7-1. This figure emphasizes the organizational responsibilities, database systems, and major operations. The CSN ASL is responsible for integrating data from the various analytical laboratories (e.g., ions, carbon, and elements) with the data from the CSN FHL, including the shipping/receiving and FSCOC. After level 0 and level 1 validation, the data are provided monthly to the DVL to upload into the DART. The DVL notifies (via email) the data validators for the <Monitoring Organization> that the data are available in DART for review and data validation. The <Monitoring Organization> conducts Levels 2 and 3 data validation through DART and notifies the DVL that data sets are acceptable or identify invalid data, or other issues, which must be addressed before the data is ready for posting to the AQS database. If an SLT does not review and approve their data in DART by the specified time frame, the data will be considered approved and sent back to the DVL. The DVL then compiles the data and sends to the ASL which uploads the data to the AQS database with appropriate flags as required.

The QAPPs for the CSN ASL (ASL 2023) and FHL (FHL 2023) provide additional information about how the data are generated and managed.

Figure B7-1. Data Management Flow



### B7.1 Data Management Activities

This section describes in more detail the data management activities and responsibilities at the <Monitoring Organization>.

#### B7.1.1 Shipping and Receiving Records

The first stage of data management activities at the <Monitoring Organization> begins with receipt of a sampling module set containing partially completed FSCOC(s) from the FHL. EPA recommends that monitoring organizations document whenever a set of sampling modules is received or shipped, by confirming the following information and recording the relevant information on the FSCOC:

*Before Sampling:*

* receipt date for each unexposed set of sampling modules;
* site identifier and sampling date that the module set is to be used;
* condition of the shipping container (if the container was damaged in shipment, the CSN FHL should be notified by noting it in the comment field); and
* person to whom the set of sampling modules is released for installation at the monitoring site (the site operator or someone who will take the modules to the site).

*After Sampling:*

* person transporting the set of exposed sampling modules back to the shipping area;
* site identifier and sampling date that the sampling module set was exposed;
* condition of the modules and the shipping container;
* express air bill number and destination (the CSN FHL’s shipping address should be pre-printed on air bills supplied with each module set); and
* one copy of the multi-part FSCOC should be retained by the monitoring organization and checked to ensure that all information is complete and legible.

These shipping and receiving records may be necessary references in the event discrepancies are later identified in data. <Each monitoring organization should develop its own system for maintaining shipping and receiving records. Describe monitoring organization’s system for maintaining shipping and receiving records here.>

#### B7.1.2 Field Sampling Chain of Custody (FSCOC) Data Form

The FSCOCs are shown in Figures B3-1 and B4-5 of this QAPP. The field operator is responsible for accurately completing and verification of the form(s). The handwritten notations on the form are the sole record that the CSN laboratories will have for critical information, including:

* site/date of sample collection (usually preprinted on the FSCOC, but the operator may indicate changes);
* total sampled volume(s) for each of the sampling channels;
* average ambient and filter temperature(s), flow(s), and barometric pressure;
* the CV of the sampler’s flow rate over the sampling period;
* actual sampling duration;
* data flags assigned by the sampler and recorded in the field;
* comments regarding any unusual events that may affect the results;
* information about field blanks included with the set of sampling modules; and
* operator's name and recorded observations.

The FSCOCs are formatted so that there is a specific space for each item noted above and are customized for each speciation sampler. The operator will repack the exposed modules and return the top copy of the FSCOC in the shipping/transport package. The operator is responsible for keeping one copy and returning it to the <designated person> at the <Monitoring Organization> for filing and later use in data validation.

#### B7.1.3 Data Management Activities During Data Validation by the <Monitoring Organization>

Data validation is a combination of checking that data processing operations have been carried out properly and of monitoring the quality of field and laboratory operations. The specific procedures used for data validation are described in Section D1.

If a problem is identified, the data can be corrected or invalidated, and corrective actions can be taken to prevent its recurrence. The following considerations relative to data management practices during data validation will apply. Flags denoting error conditions or QA status will be associated with each observation down to the level of individual analyses, but flags must never overwrite the data values so that recovery and review of the original data will be possible. However, if a value is deemed invalid or null, based upon associated flags and other evaluations, a null data code will be substituted for the original value during entry to AQS.

Every month the data validation contact(s) at the <Monitoring Organization> are notified that the next “Batch” of data is available for review through DART. The ASL has 60 calendar days from receipt of samples from the FHL to analyze and post data for review in DART. In addition to information on the sampling data acquired for the period covering that batch, DART will contain the site’s data summary and associated validation information prepared by the CSN ASL that requires further review/validation by the monitoring organization. The CSN FHL and ASL will have performed the following level 0 and level 1 validation prior to loading into DART. Examples of level 0 and 1 validation include the following:

* Level 0: Routine checks made during the initial data processing and generation of data, including proper data file identification, review of unusual events, review of field data sheets and result reports, instrument performance checks, and deterministic relationships (exact relationships between variables).
* Level 1: Tests for internal consistency to identify values in the data which appear atypical when compared to values of the entire or whole data set.

The <Monitoring Organization> will perform level 2 and 3 data validation. Examples of level 2 and 3 data validation include the following:

* Level 2: Comparison of the current data set with historical data to verify consistency over time. This level can be considered a part of the data interpretation or analysis process.
* Level 3: Tests for parallel consistency with data sets from the same population (region, time period, air mass, etc.) to identify systematic bias. This level can also be considered a part of the data interpretation or analysis process.

The <Monitoring Organization> will use its in-house records such as monthly performance verifications, audits, and other QC checks provided in Tables B4.1 and D1.3 to examine data with data qualifiers and those that appear to be outliers. Questions about flags applied by the CSN FHL or ASL should be sent through the EPA CSN Regional Representatives or to [csnsupport@sonomatech.com](mailto:csnsupport@sonomatech.com).

#### B7.1.4 Reporting Data to AQS

After the dataset has undergone levels 2 and 3 data validation, the <Monitoring Organization> is responsible for making any appropriate revisions of the data within DART. The <Monitoring Organization> has 30 days to review the data before DART automatically sends the data back to the DVL. The ASL then has 30 days to upload data into AQS.

Monthly flow rate verification and semi-annual sampler flow audit QA/QC data from the <Monitoring Organization > are required to be uploaded to AQS per 40 CFR 58.16 and following instructions given in the AQS Data Coding Manual (<https://aqs.epa.gov/aqsweb/documents/codingmanual/html/fromdatabase/Speciation%20Flow%20Rate%20Verification.html>).

### B7.2 Recommended Data Management Practices

This section describes recommended data handling practices applicable to the CSN field operations.

#### B7.2.1 Sample and Data Tracking

The <Monitoring Organization> must develop methods for tracking, shipping, and receiving samples and for filing FSCOCs, audit reports, and other CSN-related paperwork. <These records may be hardcopy or electronic, at the organization's discretion; explain process here. Adoption of procedures like those already in use for other programs such as the National PM2.5 Monitoring Network is encouraged.> Retention of data records and documents is covered in Section B7.2.2.

#### B7.2.2 Data Recording, Security, and Archiving

The <Monitoring Organization> shall address data security in their data management processes for the CSN and other reportable environmental data. <Describe specific measures here.>

Archival of raw data and other program information is important because it permits reconstruction of data collection and other processes when results are challenged or when data are examined for research purposes. Table B7-1 summarizes the types of data and records that should be retained by the <Monitoring Organization> for a minimum of five years.

Table B7.1 Required Monitoring Organization Data Record Archival Summary

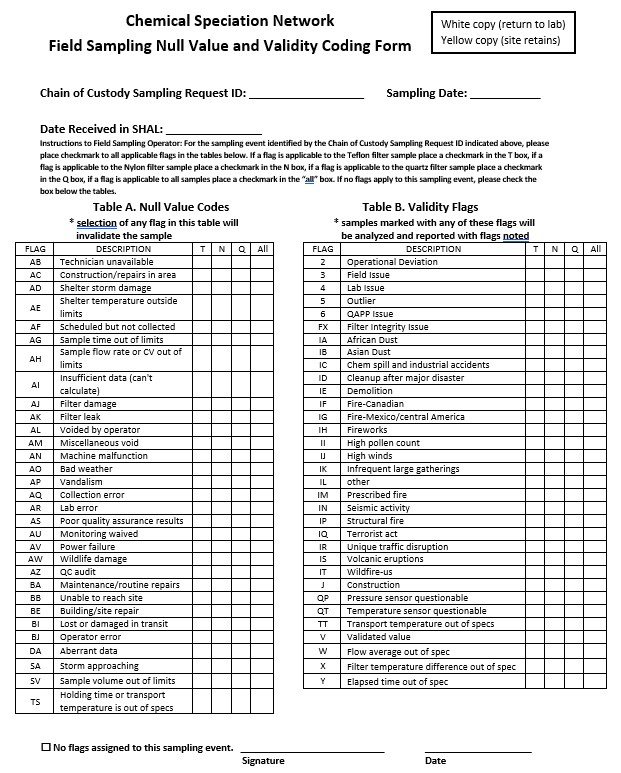
| Type of Record |
| --- |
| Completed FSCOCs |
| Shipping records |
| Field site logbooks and supplemental notes |
| Certificates for all equipment and materials standards (e.g., NIST or manufacturer's certificate) |
| Instrument calibration and QC records |
| Instrument maintenance and service records |
| Audit trails generated during data validation |
| QA records, including audit checklists and audit reports |
| Copies or files of all fully validated data sets sent from the <Monitoring Organization> to DART for transfer to AQS |
| Correspondence with the EPA CSN Regional Representatives, including consolidated sample requests |
| Training records |

<A qualified reviewer, such as a qualified analyst or the QA Officer,> shall also randomly examine selected data transfer operations for reasonableness beforedata are reported. These checks are often automated screening programs, particularly for within-record checks. The <Monitoring Organization> shall verify the completeness (determined by the ASL and reported to DART) of the data set by checking that all exposures have been accounted for by comparison with FSCOCs and other records. An audit trail is strongly recommended to document all changes made to the data set during validation operations. Audit trails are described in Section B7.2.4.

#### B7.2.3 Data Flagging

The field operators are responsible for adding the necessary flags to the FSCOC using the form shown in Figure B7-2. Following data validation, individual data points can be marked by a variety of flags to indicate quality of the data. AQS permits entry of qualifier codes consisting of three types relevant to the CSN: Informational Only, QA Qualifier, and Null Data Qualifier. All uploaded data must be validated and when warranted appropriately qualified in AQS. More than one qualifier may be reported with a concentration value to provide additional information regarding the applicable concentration result. However, the null data qualifier flag, which invalidates sample results, must not be entered with other flags, as such a flag indicates that no concentration data are reported. Records with a null data qualifier are still uploaded to AQS but exclude a concentration value. The CSN FHL and ASL databases contain flags for internal use to facilitate QC reporting; however, these flags will be mapped onto the set of approved AQS flags when the DVL enters data into DART. The AQS data flags used for CSN are given in Figure B7-2. The AQS website has the official list of all qualifier flags: <https://aqs.epa.gov/aqsweb/documents/codetables/qualifiers.html>; however, not all flags on the AQS website are applicable to CSN.

Figure B7-2. Example Field Sampling Null Value and Validity Coding Form



#### B7.2.4 Audit Trails

The audit trail is an important means for documenting changes to a data set made during validation and are typically used when monitoring organizations are using electronic logbooks and software rather than hard copy notebooks. <Monitoring organizations considering the implementation of electronics logbooks should reference Appendix J of the *Quality Assurance Handbook for Air Pollution Measurement Systems Vol II,* (U.S. EPA 2017a).>

The audit trail is important for establishing the reason for data changes, the authority under which the change was made, and the data values before and after the change was applied. Monitoring organizations are required to implement audit trails. <If Monitoring Organizations implement audit trails differently than the bullets below, modify these bullets in B7.2.4 to describe the monitoring organization’s actual audit trail process).> Typical reasons for making audit trail entries include the following:

* corrections of data input due to human error;
* application of revised calibration factors to sample results from an analytical run queue;
* addition of new or supplementary data;
* flagging of data that are invalid or suspect based on manual examination or automated validation of the data; and
* logging of the date and time when automated data validation programs are run.

Audit trail records usually include the following fields:

* person’s identity;
* date and time of the change;
* table and field names for the changed data;
* complete identifying information for the item changed (date, time, and so on);
* value of the item before and after the change (or image of the entire record before and after the change).

### B7.3 Data Analysis

For the field activities covered by this QAPP, data analysis techniques and products will not apply. Tools to ascertain the air quality trends or make air quality assessments are beyond the scope of this QAPP.

EPA encourages monitoring organizations to maintain and update control charts to track the performance of CSN samplers over time. Specifically, the flow, temperature, and pressure check results should be monitored to identify and correct measurement drift before a routine sample is collected with an out-of-spec sampler.

### B7.4 Data Storage and Retrieval

Data storage and retrieval techniques for the <Monitoring Organization> is described in <SLT system documentation or through in-house SOPs developed for the CSN program>. Documentation of data storage and retrieval includes a summary of the type of data, the media on which they are stored, the method of retrieval, security measures for safeguarding the data against destruction and access by unauthorized persons, and the retention time for the data. <Provide examples or additional detail about techniques here or attach SOPs as appendix to this QAPP.>

# Assessment and Oversight

## C1. Assessment and Response Actions

A variety of internal and external assessments will be conducted for the CSN. This section discusses the types of assessments to be conducted, the frequency for conducting these assessments, and how the results will be reported. Assessments are done throughout the project to identify potential problems and allow for timely corrective action.

### C1.1 Types of Assessments

The following types of assessments will be performed for the CSN:

* Annual monitoring network plans and 5-year network assessments (per 40 CFR Part §58.10),
* External TSAs that are done by the Regions and can be included as part of other monitoring network TSA evaluations,
* Flow rate verifications (SLTs) – monthly,
* Flow rate audits (SLTs) semi-annually,
* National contract laboratories TSAs, overseen by EPA – every 3 to 5 years.

<Internal TSAs are recommended to be conducted annually but unlike the activities above are not required to be performed. If SLTs choose not to perform internal TSAs, delete the preceding sentence and the “TSAs (internal) of field operations” row in Table C1.1.> Details regarding network reviews, TSAs, and PEs are described in Section 15 of the *Quality Assurance Handbook for Air Pollution Measurement Systems Vol II,* (U.S. EPA 2017a) and the *Quality Assurance Guidance Document on Conducting Technical Audits of Ambient Monitoring Programs* (U.S EPA 2017b).

### C1.2 Assessment Frequency

Assessments should be performed at the frequency described in Table C1-1.

Table C1.1 Assessment Summary

|  |  |  |  |
| --- | --- | --- | --- |
| Assessing Agency | Type of Assessment | Entity Assessed | Frequency |
| Regional Offices† | TSAs | SLT monitoring organizations and sites | Once every 3 years (as part of the regularly scheduled NAAQS TSAs) |
| Regional Offices with Monitoring Organizations | Network Review and Approval | SLT monitoring organizations | Annually |
| Regional Offices with Monitoring Organization | Network Assessment | SLT monitoring organizations | Once every 5 years |
| <Monitoring Organization> | TSAs (internal) of field operations | <Monitoring Organization> | Annually |
| <Monitoring Organization> | Flow rate Verifications | Every Sampler | Monthly |
| <Monitoring Organization> | Flow rate Audits | Every Sampler | Semi-annually |
| EPA HQ | TSAs | National contract laboratories | Every 3 to 5 years |

†EPA Regional Offices during their 3-year TSA, or OAQPS on an ad hoc basis as needed, will conduct federal level TSAs

### C1.3 Acceptance Criteria

The assessment acceptance criteria were originally based on the DQO established for the network (Section A6). Table B4-1 summarizes the acceptance limits for field operation of the CSN samplers. When <Monitoring Organization> operators recognize significant performance issues or changes in the field operation of the samplers, these shall be brought to the attention of and addressed by the <Monitoring Organization> QA lead.

### C1.4 Sampler Performance Audits

The <Monitoring Organization> will audit each CSN sampler(s) with an independent (different than that used to calibrate the sampler and perform the monthly QC checks), NIST-traceable flowrate transfer standard on at least a semi-annual basis to verify that flow rate, temperature, and barometric pressure measurements are within specification. Sampler audits should be performed by an individual other than the site operator, preferably the < Monitoring Organization> QA representative, but must be performed with an independent flowrate transfer standard. For samplers with multiple flow channels, each channel and the associated sensors will be audited. Table C1-2 lists the audit criteria tests, their acceptance criterion, and the frequency of performance. The CSN Sampler Flow Audit and Monthly Flow Check Worksheet (U.S. EPA 2024) is to assist SLT monitoring organizations in recordkeeping and reporting of flow rate audits and flow checks to AQS.

The transfer standards must be certified by an independent metrology lab or the manufacturer’s facility annually. Recertification or recalibration can occur at the manufacturer’s facility or at a metrology laboratory that uses current NIST-traceable equipment of a higher precision and accuracy than the transfer standard being certified. See section B5 of this QAPP for guidance and reference to recertification and recalibrations. Tables B5-1 and B5-2 provide CSN specifications for recertification and calibration of standards.

Table C1.2 Performance Audits and Acceptance Criterion

| Criteria | Acceptance  Criterion | Frequency |
| --- | --- | --- |
| Leak test | Met One: ≤ 0.1 L/min  URG: ≤ 225 mmHg vacuum pressure loss for 35 seconds | Semi-annual |
| Temperature | ±2°C of a NIST-traceable standard that is independent of the monthly check standard | Semi-annual |
| Pressure | ±10 mmHg vs. a NIST-traceable standard that is independent of the monthly check standard | Semi-annual |
| Flow rate | ±10% sampler indicated flow vs. independent standard flow.  ±10% of sampler design flow  vs. independent standard flow. | Semi-annual |
| Clock/timer | ≤ 1 min from standard time | Semi-annual |

### C1.5 Assessment Reports

A TSA is an on-site review and inspection of the monitoring organization’s program to assess its compliance with guidelines governing the collection, analysis, validation, and reporting of ambient air quality data. <Monitoring organizations should perform their own internal TSA of field operations at each CSN site in their network on an annual basis (Section C1.5.1). If SLTs choose not to perform internal TSA, delete the highlighted text and Section C1.5.1.> The EPA Regional Offices will perform TSAs of each PQAO every three years. As part of the regularly scheduled NAAQS TSAs, regional offices will include CSN field operations as part of the audit. Aspects to be audited include adherence to their CSN Field QAPP, siting criteria (40 CFR Part 58 Appendix E), CSN sampling handling and chain of custody procedures, and an audit of data quality (one sampling event).

The <Monitoring Organization> will incorporate CSN as part of the annual monitoring network plan and 5-year network assessments. These reviews are used to determine how well the network design is meeting the monitoring objectives and how the network should be modified, if needed, to meet the objectives. If the annual monitoring network plan or assessment proposes changes to STN or NCore sites, OAQPS approval is needed prior to site relocation or shutdown. If changes to supplemental sites are proposed, CSN Regional Representatives should notify OAQPS of the modification.

The <Monitoring Organization> will look at results for individual CSN flow verifications and audits for their CSN sites, ensure the results were entered into AQS, and ensure the corresponding CSN speciation data have been appropriately qualified or invalidated, following the criteria included in Table C1-2.

#### C1.5.1 SLT Monitoring Organization’s Annual Internal Assessments

For the CSN program, a state led internal TSA of field operations should be performed on an annual basis. It is recommended that the internal TSA have a designated audit lead. It is further suggested that the audit lead develop an audit plan. The audit lead should arrange a tentative schedule for meetings with key personnel as well as a schedule for inspection of CSN measurement operations. At the same time, a schedule should be tentatively set for the exit meeting that will be used to debrief its management on the systems audit outcome. For TSA guidance, refer to the *Quality Assurance Guidance Document on Conducting Technical Audits of Ambient Monitoring Programs* (U.S EPA 2017b).

### C1.6 Implementation of Response Actions

After an assessment, whether by the <Monitoring Organization> QA group or the EPA Regional Representative, any necessary response actions shall be timely and effective. In certain cases, it may be necessary to perform response actions as quickly as possible. Such cases may include adverse impacts on data quality or preventing data acquisition and/or risks to personnel health and safety. Verbal approval for remedy from the responsible parties suffices under these conditions but must be followed up with documentation (e.g., Corrective Action Reports in Section C2.5). The remedy response action is primarily the responsibility of the audited <Monitoring Organization>. If issues exist that impede the successful remediation of the nonconforming sampler or operational procedures, the CSN Regional Representative should be notified and a resolution coordinated.

Response actions encompass immediate actions to resolve issues such as calibration errors and other internal procedural problems that impact overall data quality. The management of <the Monitoring Organization being evaluated>, which oversees these activities, is responsible for ensuring that these response actions are implemented effectively and promptly and shall provide evidence to the EPA Regional audit team of the effectiveness of the correction. Once such objective evidence is received, the assessment will be closed unless a reassessment is planned. In some cases, the assessment team may be needed to confirm the successful implementation of response actions. Refer to the *Quality Assurance Guidance Document on Conducting Technical Audits of Ambient Monitoring Programs* (U.S EPA 2017b)for additional information on documentation of response actions.

## C2. Oversight and Reports to Management

This section describes the quality-related reports and communications to management necessary to support CSN. Effective communication among all personnel is an integral part of a quality system. Planned reports provide a structure for apprising management of the project schedule, the deviations from approved QA and test plans, the impact of these deviations on data quality, and the potential uncertainties in decisions based on the data. These reporting documents should spell out the frequency of checks, the personnel responsible for generating the report, and recipient of the information.

Table C2-1 shows this information for the key reports to management.

Table C2.1 Summary of Reports to Management

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of Report** | **Contents** | **Author** | **Recipient** | **Frequency** |
| <Internal TSA> | <A review and inspection of the monitoring organization’s CSN quality program to assess its compliance with the QAPP and SOPs governing the collection, analysis, validation, and reporting of CSN data.> | <Author is from the sample collection agency but is an independent assessor from routine monitoring operations> | <Monitoring Organization and EPA Regional Office> | <Annually> |
| External TSA | A review and inspection of the monitoring organization’s CSN quality program to assess its compliance with the QAPP and SOPs governing the collection, analysis, validation, and reporting of CSN data. | EPA Regional Staff | Monitoring Organization QA Management | Every 3 years in conjunction with required criteria monitoring TSA |
| Routine Quality Control records | Operator's notebooks, site records, calibration records, etc. Refer to section B4. | Monitoring Organization Operations Personnel | Monitoring Organization QA Management | Maintained continuously |
| Data Validation Summaries | Operator reports. Refer to section B4. Data review of validation results. | Monitoring Site Operators or Technicians; Data Reviewers and Validators | Monitoring OrganizationQA Management | Monthly data batches |
| Corrective Action Reports and other performance related records | Identification of problems, proposed solution, and results; results of invalid tests | Monitoring Organization, QA Management | EPA Regional Office and OAQPS | As needed |

### C2.1 SLT Monitoring Organization Site TSAs (Internal)

<Each Monitoring Organization should conduct an internal TSA of the organization’s CSN operations annually. A copy of the TSA report is submitted to the appropriate EPA Regional Office. More detailed information about internal site TSAs is given in Section C1.5.1. If the SLT elects not to perform the internal TSA, delete this section and the highlighted row in Table C2.1.>

### C2.2 EPA Regional Site TSAs (External)

EPA Regional staff will perform a TSA at each PQAO at least once every 3 years. As much as is practicable, the CSN TSAs will be conducted as part of the criteria monitoring TSAs required by section 2.5 of part 58 Appendix A. When the CSN TSA is conducted as part of the criteria monitoring TSA, at least one of the sites selected in the PQAO for a site inspection will include the CSN monitoring site. The TSA report is submitted to the audited <Monitoring Organization>.

### C2.3 Routine Quality Control Records

Routine QC records such as operators' notebooks, control charts, calibration records, etc., are not considered reports to management; however, these materials must be maintained and made available for any audits and reviews. Sampler performance verification results, however, are indicators of potential loss of data and should, therefore, be reported monthly with immediate notification of the supervisor who can deploy technicians to correct the problem.

### C2.4 Data Validation Summaries

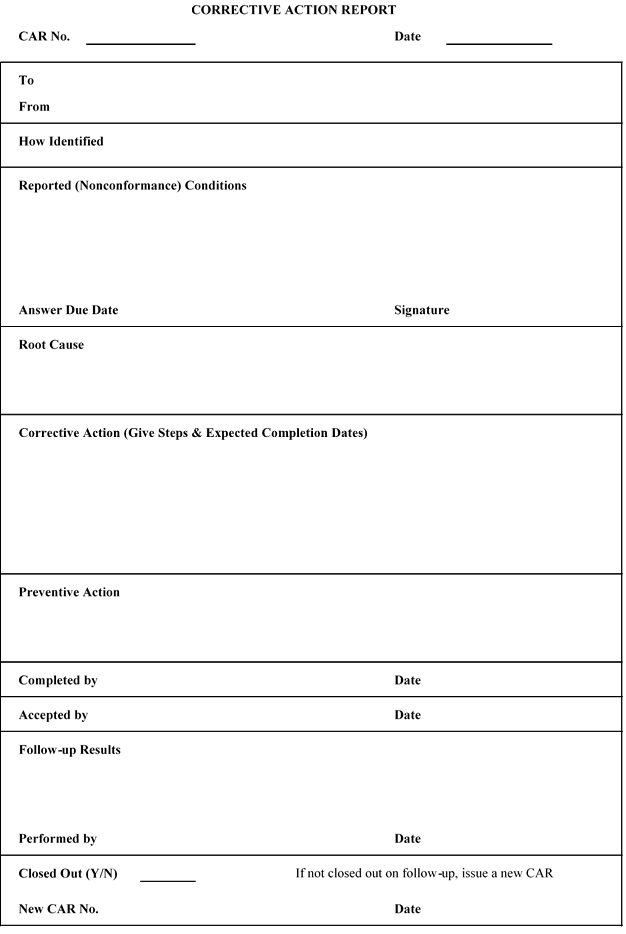
The CSN ASL, as part of the Level 0 and 1 validation, reviews data monthly and provides the concentration data with the appropriate flags to DART for review by the individual monitoring organizations. The <Monitoring Organization> has 30 days to review monitoring data once in DART. Additionally, <Monitoring Organization> conducts level 2 and level 3 data validation and review and submit corrections or comments within DART. When monitoring organizations conduct levels 2 and 3 data review in DART, sampling site records of monthly flow rate verifications or flow rate audits are consulted and used to validate data accordingly. Sixty days after the initial posting of the data to DART (30 days for SLT review plus 30 days for the ASL to review), the data, with any organization-required changes, are posted to AQS for public access. The data validation summaries produced by the ASL and the requested SLT corrections and other correspondence are not published but are maintained so that they are available for audits and reviews. Validated air quality data submitted for each reporting period will be entered into AQS using the procedures described in the ASL Data Validation SOP (ASL 2022). Outside of the validation processes in DART, the monitoring organizations have up to 6 months after posting to AQS to request change be made by the ASL. After 6 months, it becomes the <Monitoring Organization>’s responsibility to make further revisions to the data.

### C2.5 Corrective Action Reports

A corrective action reporting system shall be in place for all monitoring organizations. The corrective action report (CAR) procedure shall be followed whenever a problem is found, such as a safety issue that presents a risk to the site operators and auditors or an operational or procedural problem that will result in loss of data or generate invalid or compromised data. <An example CAR form is shown in Figure C2-1, but organizations may use their own forms. Attach as an appendix to this QAPP if monitoring organization specific form is used.>

The CAR form shall identify the originator of the report, state the problem and how it was discovered, and indicate possible solutions to the problem. The form shall also indicate the name of individuals assigned to correct the problem as well as the individual responsible for verifying that the corrective action has been completed and the problem addressed to ensure it does not recur. CARs are normally not published but shall be retained by the <Monitoring Organization> for review during audits.

Figure C2-1. Example Corrective Action Report (CAR) Form



# Environmental Information Review and Usability Determination

## D1. Environmental Information Review

Verification and validation are processes performed on individual data points or groups of data and are different than the processes followed to evaluate the DQO, which are described in Section D2 of this QAPP. The verification and validation processes determine which data has met applicable data quality specifications. Data verification is the confirmation, through objective evidence, that specified measurement quality requirements outlined in section B of this QAPP have been fulfilled. Data validation is the confirmation, through objective evidence, that the measurement results meet the intended use for the CSN program. Data verification is performed by the generators of the environmental data. Data validation is performed by staff that are independent from these data generation activities. For more detail on data verification and validation see “Best Practices for Review and Validation of Ambient Air Monitoring Data”, EPA-454/B-21-007, (U.S. EPA 2021). Only after a given dataset has been verified and validated can it be fully assessed and used to address the specific scientific and programmatic questions embodied in the DQO.

### D1.1 Data Verification and Validation Responsibilities

Verification and validation of data for the CSN is the joint responsibility of the <Monitoring Organization>, which runs the field component of the program, and the CSN FHL and ASL, who analyze the samples and calculate and report the sample concentration data. Both the field component and the laboratory operations component of the program each have data verification and data validation responsibilities.

Data verification is largely performed by <the Monitoring Organization site operators and/or the QA staff> during the Level 2 review in DART. Data validation is performed in DART during the level 3 review. Data validators are independent of the environmental data generation activities (e.g., they are not the site operators). The data validators reach out to the site operators as needed and refer to copies of the FSCOC forms to validate their data. The data validators also refer to the guidance and criteria provided in the Data Validation and Quick Reference Guide for CSN that can be found at: <https://www.epa.gov/amtic/chemical-speciation-network-data-reporting-and-validation>.

The FHL and ASL perform initial Level 0 data verification and validation based on the FSCOC received with the shipped samples. However, it is ultimately the <Monitoring Organization>’s responsibility to confirm the Level 0 data validation performed by the FHL and ASL. The ASL then performs the Level 1 data verification and validation of the laboratory measurement results performed on the CSN filter samples. Details on the verification and validation practices of the laboratory QA/QC are outside the scope of this CSN field QAPP; see ASL 2023 for details on these analytical environmental information review activities. In addition to the analytical environmental information review, during the Level 1 verification and data validation, the CSN ASL also incorporates the sampled air volume provided by the <Monitoring Organization> with the analytical measurements to compute concentrations for the CSN analytes. Except for the analytical portions of the Level 1 verification and validation activities, it is ultimately the <Monitoring Organization>’s responsibility to confirm the Level 1 data validation performed by the ASL.

After the Level 1 review is complete, it is the responsibility of the <Monitoring Organization> to complete the Level 2 and 3 of data verification and validation. Table D1.1 describes these levels and the responsibilities of the <Monitoring Organizations> for data verification and validation.

To coordinate the management of the environmental information review described above between the <Monitoring Organization> and the ASL, the CSN Program utilizes DART data management service at [https://dart.sonomatech.com/.](https://dart.sonomatech.com/) Data are uploaded to DART by the ASL and made available to authorized SLT CSN validators to review and approve. After the monthly data upload is made by the ASL, the <Monitoring Organization> are responsible for validating their data within DART where they can make changes, add qualifiers, and add comments for the ASL and/or FHL to address. At the conclusion of the <Monitoring Organization> Level 2 and 3 reviews, the ASL uploads the validated CSN data to EPA’s AQS database.

Table D1.1 CSN Data Validation Levels

|  |  |  |  |
| --- | --- | --- | --- |
| **Level** | **Responsibility** | **Activities** | **Frequency** |
| Level 0 | CSN ASL and FHL | Review of sampler-generated data recorded by site operators, application of qualifiers and null codes based on operational data. | Upon receipt of each sample shipment. |
| Level 1 | CSN ASL | Review of laboratory results and dataset checks based on species ratios, comparison with reconstructed mass, comparisons with historical data, etc. Reconcile with sampler-generated data. | Prior to each data upload to DART |
| Level 2 | SLT Validators via DART/Field Site Operator | Reconcile with local events, sampler flow checks/validation, and consistency with field site operator records. Compare data with nearby sites and historical datasets. | Monthly; for each dataset upload to DART |
| Level 3 | SLT Validators via DART | Independent reviewer conducts final data review to ensure data review is finalized and data are ready for submission to AQS. | Monthly; for each dataset upload to DART |

Table D1.2 Data Verification and Validation Activities for the CSN

| **Verification and/or Validation Activity** | **State, Local or Tribal Monitoring Organization Responsibility** |
| --- | --- |
| Sample collection. | The <Monitoring Organization> compares the information on the FSCOC (e.g., the site, date, time, and channel assignments) with labels on modules received. The <Monitoring Organization> reports any discrepancies to the CSN FHL. Logbooks, reporting forms, data custody sheets, and electronic data transmittals are checked for consistency.  The FSCOCs are corrected to reflect the actual module used for a particular sampling channel, if other than originally assigned by the laboratory.  Discrepancies in module assignment due to procedural errors in the field operation are corrected and documented. |
| Periodic inspection of siting criteria. | The <Monitoring Organization> is responsible for verifying siting criteria is met at least annually. See 40 CFR part 58 Appendix E for probe and monitoring path siting criteria. |
| Sampler integrity. | The monitoring organization should follow the sampler SOPs for sampler operation and/or follow those provided by the FHL. See Table B4-1.  The <Monitoring Organization> conducts internal audits. <remove sentence if Internal TSAs are not performed>. The <Monitoring Organization> participates in external audits and reviews of its sample handling and data processing systems.  The <Monitoring Organization> coordinates with investigations of data integrity initiated by the CSN FHL and ASL, the SLT QA lead, OAQPS, the regions, or others.  The CAR process is followed when investigating isolated or systematic discrepancies. |
| Checks on sample containers and preservation methods. | The field operator is responsible for checking the integrity of shipping containers and individual modules upon receipt or deployment at the site. The CSN FHL is notified immediately of any damage that may have occurred in shipment and is documented on the FSCOC. |

### D1.2 Use of QC Information for Verification and Validation

The various QC samples collected for the CSN provide information for data verification/validation and are summarized in Table D1-3.

Table D1.3 Quality Control Data for Data Verification and Validation

| Type of QC Data | Responsibility | Usage for Verification and Validation |
| --- | --- | --- |
| Field Blanks | Lab | * High field blank values are indicative of sample contamination. * Data may be flagged or invalidated based on the results of investigation. |
| Sampler leak check | Field | * Sampler leak checks designed to indicate a pass or fail situation. * For failed test, consult operator’s manual or contact the manufacturer. * The <Monitoring Organization> reports failed leak checks during the DART data validation process. |
| Sampler temperature, barometric pressure sensor | Field | * Sensor failures can directly affect flow and require investigation. * Operators quantitatively document errors and determine when the sensor began to malfunction. * Data back to the last successful check may be suspect. * See Table B4-1; The <Monitoring Organization> reports failures during the DART validation process. |
| Sampler flow rate check/audit results | Field | * Sampler flow rate and CV directly affect sample volume and concentration calculations. * Data back to the last successful check may be suspect. * Results from flow checks and/or audits must be used in data validation via DART to qualify and/or invalidate data when failing criteria given in Table B4-1. |

### D1.3 Use of Calibration Information for Verification and Validation

Transfer standards (e.g., pressure, temperature, flow, etc.) used in sampler calibrations must be within valid certification periods. Documentation of these certifications shall be confirmed during data verification and validation processes.

### D1.4 Treatment of Deviations from Requirements

Deviations from requirements call for a variety of response activities that are summarized below:

**Flag Data in AQS:**CSN data shall be marked with a data qualifier flag only if the data have noted issues and are still considered **valid**.

**Invalidate Data in AQS:** Data of unacceptable levels of quality or uncertainty shall be invalidated and not be included as a concentration value in AQS. The corresponding concentration data will be reported as missing along with an appropriate AQS null value code.

**Corrective Action Reporting Process:** The <monitoring organization>’s CAR process shall be followed in cases of systematic problems or problems affecting a significant number of data points. The CAR process is described in Section C2.5.

**Notification of EPA or Other Stakeholders:** The investigation of a serious or systematic problem shall involve field operators, data analysts, and other personnel involved with the situation being investigated, as well as stakeholders who might be affected by the decision to validate or invalidate data. The <Monitoring Organization> shall contact the EPA CSN Regional Representative to provide documentation of corrective actions that might affect the status of reportable data. EPA CSN Regional Representatives may consult CSN QA and Program leads, if warranted. The <Monitoring Organization> shall include significant QA problems in their reports to management (Section C2).

## D2. Useability Determination

DQOs define the appropriate type of data to collect and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the CSN monitoring objectives. The process of setting DQOs helps ensure that the type, quantity, and quality of environmental monitoring data will be sufficient for the data’s intended use or purpose. As data are collected, the initial DQOs will be revisited by EPA HQ to determine whether those data meet the DQOs. The CSN DQOs and the statistical model used to determine them is described in *Data Quality Objectives for the Trends Component of the PM2.5 Speciation Network* (U.S. EPA 1998). Additionally, when determining whether the data meet the DQO, the ability of the network to meet (or exceed) the measurement quality objectives (MQOs) will also be considered. The MQOs are precision-based and evaluated using six collocated CSN sites. The MQOs are a CV of 10% for ions, 15% for carbon, and 20% for elements (U.S. EPA 1999b). The primary DQO for the CSN is stated to be the ability to detect a ±5% annual trend over 5 years with statistical power of 0.80. The ASL evaluates the collocated CSN data for precision MQOs. EPA HQ periodically determines whether the CSN data continues to meet the intended uses for network data. Annual CSN QA Reports and data advisories will be used to document and communicate useability of network data and are available at: <https://www.epa.gov/amtic/chemical-speciation-network-data-reporting-and-validation>.

## References

The following provides a list of documents referred to in this QAPP. Please note that the hyperlinks provided are current as of the date the QAPP was finalized and may change.

* ASL (Analytical Services Laboratory) 2022. SOP #801 “Processing & Validating Raw Data” and supporting “CSN Data Delivery” Technical Information Document #801D located here: <https://aqrc.ucdavis.edu/documentation>
* ASL (Analytical Services Laboratory) 2023. Analytical Services Laboratory Quality Assurance Project Plan for the Chemical Speciation Network, November 2023. <https://www.epa.gov/system/files/documents/2023-12/ucd_csn_qapp_v1.6_508.pdf>
* FHL (Filter Handling Laboratory) 2023. Filter Handling, Acceptance Testing, Gravimetric Analysis, and Ion Chromatography Analysis for the Chemical Speciation Network (CSN) QAPP, Revision 0, November 2023. <https://www.epa.gov/system/files/documents/2023-12/rti-qapp-csn_final-112023.pdf>
* Met One 2011. Met One SASS Field Operation Manual (SASS-9800) [https://metone.com/wp-content/uploads/2019/10/SASS-9800-Rev-J.pdf](https://metone.com/wp-content/uploads/2019/10/SASS-9800-Rev-J.pdf%20) and SOP <https://www.epa.gov/sites/default/files/2020-04/documents/metonesasssop_0.pdf>.
* Met One 2024. Met One SASS Field Operation Manual (SASS-9805). https://www.epa.gov/system/files/documents/2024-12/sass-9805-rev.-c-web\_508.pdf
* URG (University Research Glass) 2010. URG3000N Sequential Particle Speciation System Operations Manual [https://www.epa.gov/sites/default/files/2020-04/documents/urg3000nopmanual.pdf](https://www.epa.gov/sites/default/files/2020-04/documents/urg3000nopmanual.pdf%20) and SOP <https://www.epa.gov/sites/default/files/2020-04/documents/urg3000nsop.pdf>.
* U.S. EPA (Environmental Protection Agency) 1998. *Data Quality Objectives for the Trends Component of the PM2.5 Speciation Network*, U.S. Environmental Protection Agency, Research Triangle Park, NC. <https://www.epa.gov/sites/default/files/2017-01/documents/dqos_for_pm2.5_trends_and_speciation_monitoring_network_1998.pdf>
* U.S. EPA (Environmental Protection Agency) 1999a. *Particulate Matter (PM2.5) Speciation Guidance Document (Final Draft)*, U.S. Environmental Protection Agency, Research Triangle Park, NC. https://www.epa.gov/sites/default/files/2017-01/documents/final\_draft\_pm2.5\_speciation\_guidance\_1999.pdf
* U.S. EPA (Environmental Protection Agency) 1999b. *Strategic Plan: Development of the Particulate Matter (PM2.5) Quality System for the Chemical Speciation Monitoring Trend Sites*. April 16, 1999. <https://www.epa.gov/sites/default/files/2020-07/documents/strategic_plan_development_of_pm2.5_quality_sytem_for_csn_1999.pdf>
* U.S. EPA (Environmental Protection Agency) 2001. *Evaluation of PM2.5 Chemical Speciation Samplers for Use in the EPA National PM2.5 Chemical Speciation Network;* EPA-454/R-01-005. U.S. Environmental Protection Agency, Research Triangle Park, NC. <http://www.epa.gov/ttn/amtic/files/ambient/pm25/spec/fourcty.pdf>
* U.S. EPA (Environmental Protection Agency) 2008. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements*; EPA/454/B-08/000, U.S. Environmental Protection Agency, Washington, DC. <https://www.epa.gov/sites/default/files/2021-04/documents/volume_iv_meteorological_measurements.pdf>
* U.S. EPA (Environmental Protection Agency) 2016. *Quality Assurance Guidance Document 2.12. Monitoring PM2.5 in Ambient Air Using Designated Reference or Class I Equivalent Methods*. EPA-454/B-16-001. January 2016. <https://www.epa.gov/sites/default/files/2021-03/documents/p100oi8x.pdf>
* U.S. EPA (Environmental Protection Agency) 2017a. *Quality Assurance Handbook for Air Pollution Measurement Systems Vol II, January 2017* EPA-454/B-17-001. <https://www.epa.gov/sites/default/files/2020-10/documents/final_handbook_document_1_17.pdf>
* U.S. EPA (Environmental Protection Agency) 2017b. *Quality Assurance Guidance Document on Conducting Technical Audits of Ambient Monitoring Programs*. November 2017. <https://www.epa.gov/system/files/documents/2024-01/tsagd-final-draft-11-17-17_508.pdf>
* U.S. EPA (Environmental Protection Agency) 2021. Best Practices for Review and Validation of Ambient Air Monitoring Data, EPA-454/B-21-007, August 2021. <https://www.epa.gov/system/files/documents/2021-10/data-validation-guidance-document-final-august-2021.pdf>
* U.S. EPA (Environmental Protection Agency) 2024. Quality Assurance Plan Standard, Directive No. CIO 2105-S-02.1. <https://www.epa.gov/system/files/documents/2024-04/quality_assurance_project_plan_standard.pdf>
* U.S. EPA (Environmental Protection Agency) 2024. CSN Flow Rate Audit and Monthly Flow Rate Check Worksheet. <https://www.epa.gov/amtic/chemical-speciation-network-quality-assurance>

## Appendix A

### Appendix A-1. Acronyms and Abbreviations

AAMG Ambient Air Monitoring Group

AAMMS Ambient Air Monitoring Methods Subcommittee

AMTIC Ambient Monitoring Technical Information Center

AQI Air Quality Index

AQS Air Quality System

ASL Analytical Support Laboratory

°C Celsius

COC Chain-of-Custody

CAR Corrective Action Report

CASAC Clean Air Scientific Advisory Committee

CFR *Code of Federal Regulations*

CSN (PM2.5) Chemical Speciation Network

CV Coefficient of Variation

DART Data Analysis and Reporting Tool

DVL Data Validation Laboratory (responsible for DART)

DQA Data Quality Assessment

DQI Data Quality Indicator

DQO Data Quality Objective

EC/OC Elemental Carbon/Organic Carbon

EDXRF Energy-Dispersive X-ray Fluorescence

EPA Environmental Protection Agency

FEM Federal Equivalent Method (for PM2.5 sampling)

FHL Filter Handling Laboratory

FSCOC Field Sampling Chain of Custody

FRM Federal Reference Method (for PM2.5 sampling)

HIPS Hybrid Integrating Plate/Sphere

IC Ion Chromatography

IMPROVE Interagency Monitoring of Protected Visual Environments (network or sampler)

LPM Liters Per Minute

MQO Measurement Quality Objective

NAAQS National Ambient Air Quality Standard

NCore National Core (monitoring network)

NIST National Institute of Standards and Technology

NOAA National Oceanic and Atmospheric Administration

NWS National Weather Service

OAQPS (EPA) Office of Air Quality Planning and Standards

ORD (EPA) Office of Research and Development

PE Performance Evaluation

PM2.5 Particulate Matter, 2.5 micrometers in diameter and less

PO Project Officer

PQAO Primary Quality Assurance Organization

PTFE Polytetrafluoroethylene

QA Quality Assurance

QAL Quality Assurance Lead or Leader

QAPP Quality Assurance Project Plan

Qavg Average Flow Rate

QC Quality Control

QMP Quality Management Plan

QSA Quality System Assessment

SAB Science Advisory Board

SASS Speciation Air Sampling System (Met One Instruments, Inc.)

SIP State Implementation Plan

SLAMS State and Local Air Monitoring Station

SOP Standard Operating Procedure

SLT State, Local and/or Tribal agency or monitoring organization

STN Speciation Trends Network

TOR Thermal Optical Reflectance

TSA Technical Systems Audit

µg/m3 Micrograms per Cubic Meter

<MO Name> <Monitoring Organization Name>

1. The approval date of the QAPP is the date of the Delegated Regional QA Manager approval unless otherwise specified. [↑](#footnote-ref-2)