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&
Quality Assurance
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Standard Operating Procedures for Data Validation and Verification

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Disclaimer

Any mention of equipment manufacturers, instrument or equipment model numbers, commercial vendors or suppliers does not represent an endorsement by the State of Alaska or the Department of Environmental Conservation.



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1. PURPOSE & SCOPE

This document shall establish standard operating procedures (SOP) for the data validation and verification of continuous and filter-based monitoring data, either collected by the Alaska Department of Environmental Conservation (DEC) or subject to regulatory review by DEC. The purpose of this SOP is to ensure standardization of the process of flagging, annotating, reviewing, and uploading air monitoring data for submission to the U.S. Environmental Protection Agency's (EPA) Air Quality System (AQS). This SOP will be reviewed on an annual basis and amended as needed. Additionally, a thorough update will be conducted every five (5) years since procedures and software for data collection and validation change over time. This SOP will be used in conjunction with other SOPs and operations manuals for instrumentation and data handling as well as the Agilaire LLC AirVision™ (AirVision) manual and is not intended as a replacement.

2. APPLICABILITY

This document provides the basic procedures to review, validate, report and archive ambient air quality data in accordance with federal regulations and EPA quality assurance/quality control (QA/QC) requirements. It is intended as a guidance document for field operators, data analysts, supervisors and program managers responsible for implementing and operating air monitoring projects and reviewing and validating the resultant collected data. This document is generic and does not address pollutant specific data validation tables and procedures, since they are spelled out in the separate instrument/pollutant SOPs and manuals.

This document shall serve as:

- the SOP document for data verification and validation of all State and Local Air Monitoring Station (SLAMS) and National Core site (NCore) data;
- the SOP document for data verification and validation of all special purpose monitoring station (SPMS) operated by DEC or other local air pollution control agencies;
- the SOP document for data verification and validation of all special studies performed by DEC.

This SOP document, at the date of issuance, represents the latest information on data validation in regard to federal regulations as published in *Title 40 of the Code of Federal Regulations (Parts 50, 53, and 58)* and EPA requirements as listed in the *EPA Quality Assurance Handbook for Air Pollution Measurements, Volume II, Ambient Air Monitoring Program* (March 2017).

3. DATA ACQUISITION PROCESS

The process of collecting data from the air quality samplers throughout the air monitoring network involves the collection of sampler and analyzer data within the individual site data



loggers, and the transmittal of data from the site loggers to the central database on DEC's Juneau server (DECJNUAQMON2) where the data is stored for further processing. Both the original and quality checked data will be retained on either the central server or filed with station's data logger for a minimum of 10 years.

3.1 Data Collection

DEC uses the data management system developed by Agilaire LLC known as **AirVision™ (AirVision)**. AirVision polls instrument data from a data acquisition system developed by Agilaire LLC using the **Model 8872** data logger known as a **site node logger (SNL)**. Using **AV-Trend** software, the SNL polls for 1-minute, 5-minute, and 1-hour averages. Each SNL collects data from each analyzer digitally using a MODBUS communication protocol via TCP/IP or via a RS-232 connection. All meteorological data is collected from analog instruments and converted to digital, stored on the Model 8872 data logger, and averaged. All real-time data collected can be reviewed on the data logger using the AV-Trend program.

Under normal operations, the SNL continuously polls each analyzer and records the values collected from all established channels as raw concentrations. The SNL processes a poll request from instruments that provide hourly data (i.e., MET One BAM 1020) and monitors the instrument's response with a preconfigured file format that imports the data into the AV-Trend database. The central database, AirVision, polls the various SNL's AV-Trend programs approximately 10 minutes after every hour. For direct polled instruments, AirVision processes a poll request directly with the instrument. The instrument response is monitored by AirVision with a preconfigured file format that imports the data into AirVision. The data loggers do not collect data from direct polled instruments. If a SNL fails to collect data from the analyzers, the analyzer's internal data logging feature is used to recall stored concentration values when prompted to recreate data points that were missed. However, it should be noted that the internal memory capacity of the different analyzers varies and will impact the extent of backlogged data available.

AirVision utilizes an **Automatic Data Validation Processor (ADVP)**, which runs in conjunction with the 1-hour polling task. The ADVP feature reviews incoming data for preset conditions and applies flags, null codes, and annotations, as outlined in the ADVP rule (*Appendix A*). The goal of ADVP is to automate basic data review to prevent unreliable data from reporting to the real-time website and to improve efficiency of data review process. Some ADVP rules have been set up to send emails in real time to site operators to inform them of alarm conditions that were detected from the recently polled data. If a parameter is out of tolerance based on the set conditions in ADVP, the data will be flagged according to the conditions set.



3.2 Data Flow

Gravimetric and continuous data require two distinct processes for data flow used by DEC. The flow charts in Figure 1 and Figure 2 illustrate the data collection, review, and validation process for both gravimetric and continuous monitors. The Fairbanks North Star Borough nonattainment area and the required collocation in the Particulate Matter (PM) network use Federal Reference Method (FRM) monitors for PM. The gravimetric information from the Measurement Technologies Laboratories (MTL) Laboratory Information Management System (LIMS) and instrument meta data is periodically exported to AirVision. The information from both are combined into one record in AirVision. The Anchorage and Juneau areas use Federal Equivalent Monitors (FEM) for continuous PM data which is polled from the SNL or directly from the instrument as a continuous stream of data.

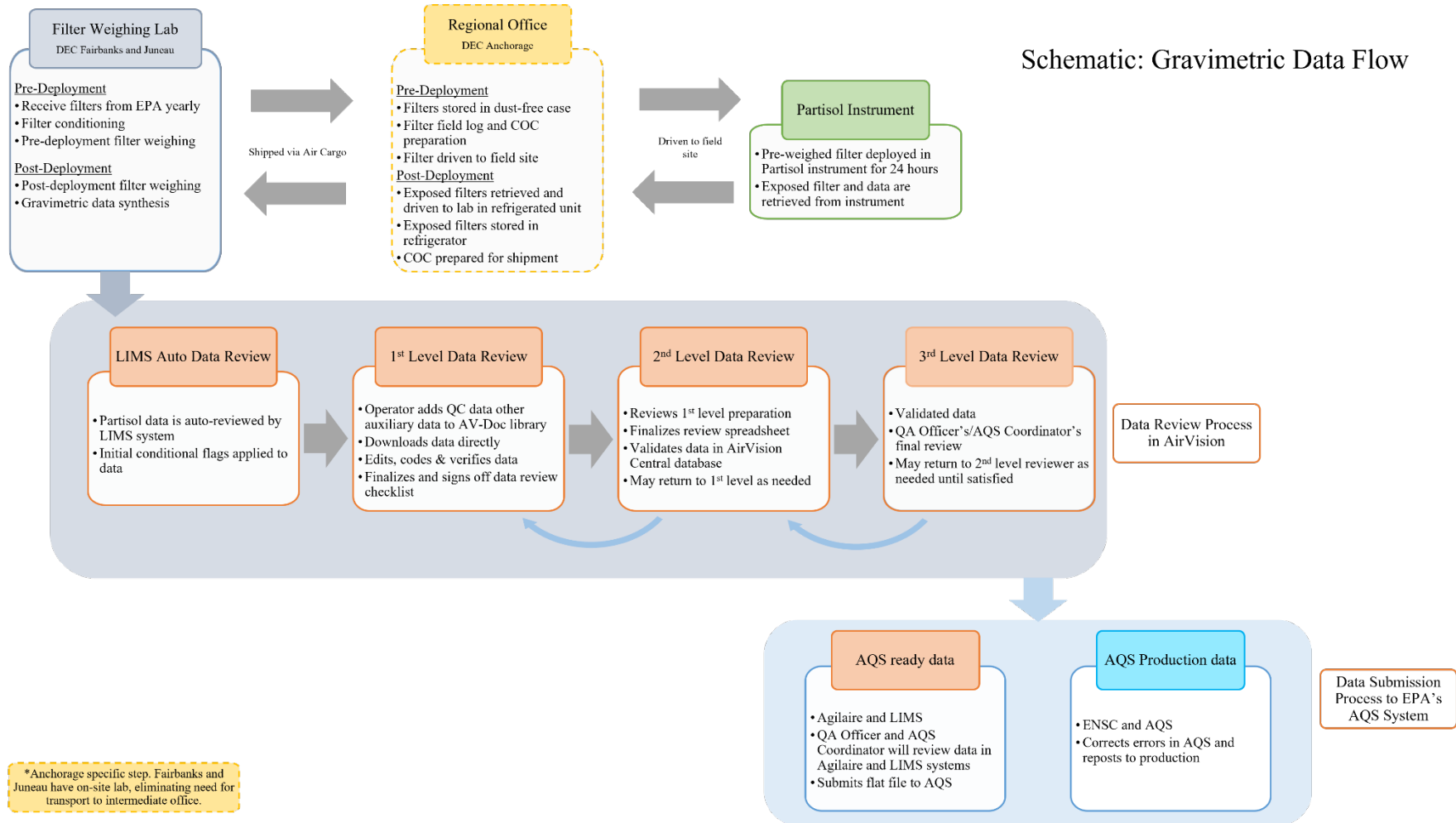


Figure 1. Gravimetric monitor data flow process for PM data collected from the manual FRM monitors.

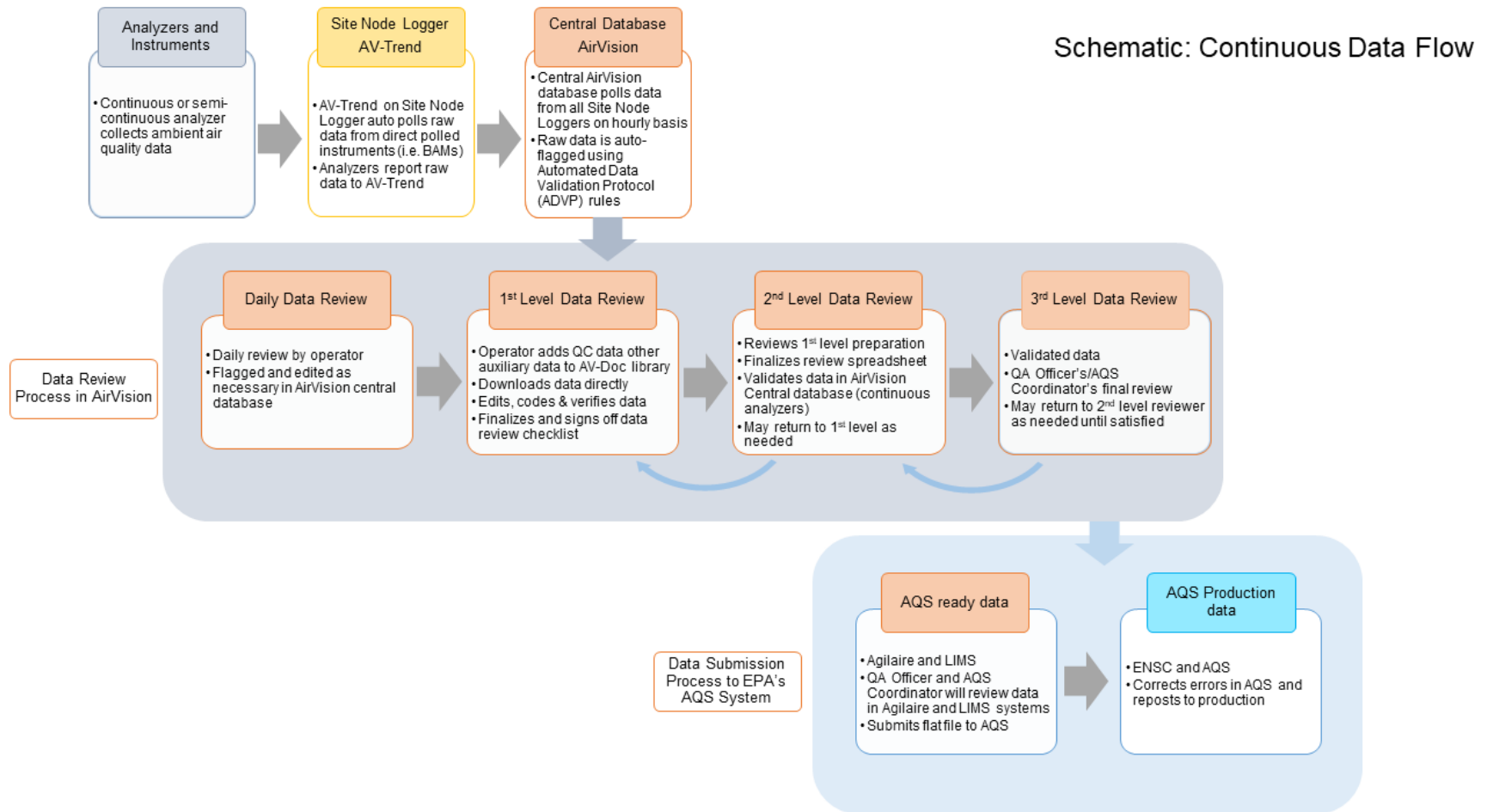


Figure 2. Continuous monitor flow process for continuous PM data and gaseous pollutant data.



4. DATA REVIEW AND VALIDATION

Data validation is the confirmation, through provision of objective evidence, that particular requirements for a specified intended use are fulfilled. To ensure that the monitoring data are meeting EPA required data quality objectives, a strict protocol shall be followed for:

- Data Acquisition – Automated Data Validation Processor (ADVP)
- Level 0 Daily Data Review
- Level 1 Data Review, Editing and Data Archival
- Level 2 Data Review and Validation
- Level 3 Final Validation
- AQS submittal
- Annual Summary Reports

An ideal data review schedule is outlined in Table 1. However, at times, limited staff resources may require adjustments to the Levels 1 and 2 schedules to accommodate timing of higher priority tasks.

Table 1. Data Preparation Review Schedule (under ideal conditions)

Level	Description	Responsible staff	Anticipated due date - continuous data	Anticipated due date – gravimetric data
0	Daily review	Site operators	1 business day after	Weighed by lab 10 days after sample date (30 days for Anchorage sites)
1	1st level preparation	Site operators	By the 15 th of the following month	By the end of the following month
2	2nd level review	Rotating basis among all staff <i>except</i> Program Manager and Quality Assurance (QA) Officer	2 weeks after, i.e. by the end of that month	2 weeks after
3	3rd level review & AQS	QA officer/ AQS manager	2 weeks after	2 weeks after
	Annual Data Certification	Site operators and Field Manager	By April 1 each year for the previous calendar year	

Level 1 and 2 reviewers are expected to conduct their reviews with consultation of the QA Officer as needed. By the time the Level 2 reviewer signs off on their review and validates the data, the QA Officer should have been advised of any unusual events occurring during the monitoring period. These discussions and consultations should be summarized and documented in the **Notes** section of the **Data Review Checklist**. A Level 3 and final review is



conducted by the data analyst or the QA officer prior to loading the data into AQS. Data is submitted to AQS on a monthly basis (raw data) and a quarterly basis (QA data). Raw data includes concentration values and any associated data collected with it (flow, pressures, temperatures, relative humidity, etc.). QA data includes QC checks (ZPS and 1-Point QC) and audits.

4.1 Data Preparation and Daily Review in AirVision

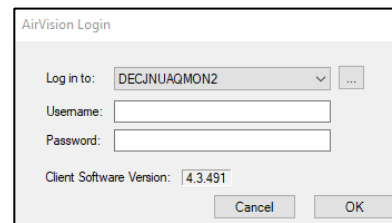
Opening AirVision

To start, AirVision will need to be installed on individual staff computers.

To open AirVision, locate the icon on the desktop or in the Start Menu.

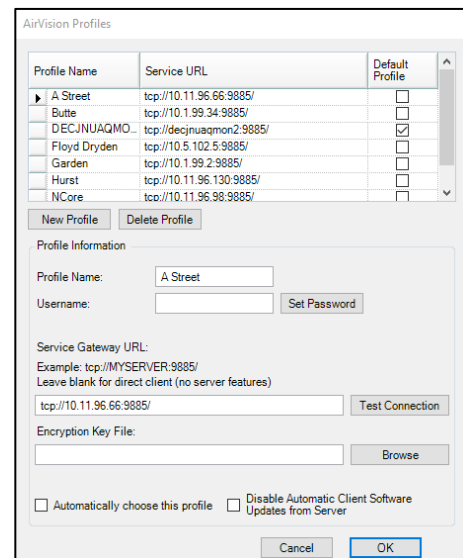


Double-click the icon and a login box will appear.



There are various connections to log into from the AirVision Login screen. DECJNUAQMON2 is the name of the central Juneau server that holds all sites' data and is where staff will review and annotate data for submittal to AQS.

Sites are set up by clicking the “...” button to the far right of ‘Log in to:’



To establish a connection to a new site:

- Select ‘New Profile’
- Enter the site’s name into ‘Profile Name’

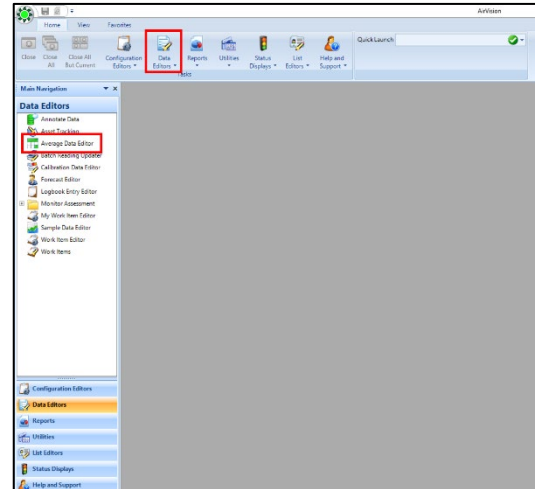


- For the ‘Service Gateway URL’, enter the site’s IP address after tcp://, so the complete URL should read: *tcp://[IPADDRESS]:9885/*
- Log into the Central AirVision client (DECJNUAQMON2) with your unique login and password credentials. If credentials are needed, staff should email DEC.AQ.AgilaireAdmin@alaska.gov.

Accessing Data Using AirVision

Site Operators are set up as Level 1 and 2 reviewers. They have access to edit minute and hourly data, repoll stations, edit calibration data, and other functions used to maintain their sites and conduct Level 2 reviews. Level 3 reviewers and administrators will be able to access all functions of AirVision with no restrictions. They will be able to edit minute and hourly data, make AQS reports for uploading, edit station metadata and other functions that allow the user to run reports.

The **Average Data Editor** provides the most data review features. There are two ways to navigate to all features, which is either through the **Navigation Pane** on the left side of the screen or the drop-down menus along the top bar on when on the **Home** tab. When AirVision opens, click on ‘**Data Editors**’ in the **Navigation Pane** and then single click on ‘**Average Data Editor**’.



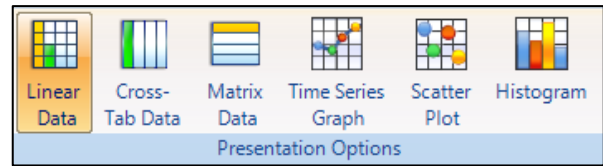
Once the **Average Data Editor** is open, start and end dates and times can be defined by either clicking the date and time values in the box and using the arrow keys to toggle values up and down or by manually entering the values into the date/time box. Additionally, preset date ranges can be selected by clicking on the star button. Next, select the sampling time interval, site(s) and parameter(s) desired. To select multiple sites and/or parameters, either hold the shift key and click the first and last of the sites/parameters in a continuous list or hold the ctrl key and select individual sites/parameters anywhere in the list.



When all details are selected, click ‘**Retrieve Data**’ in the top left corner of the screen.

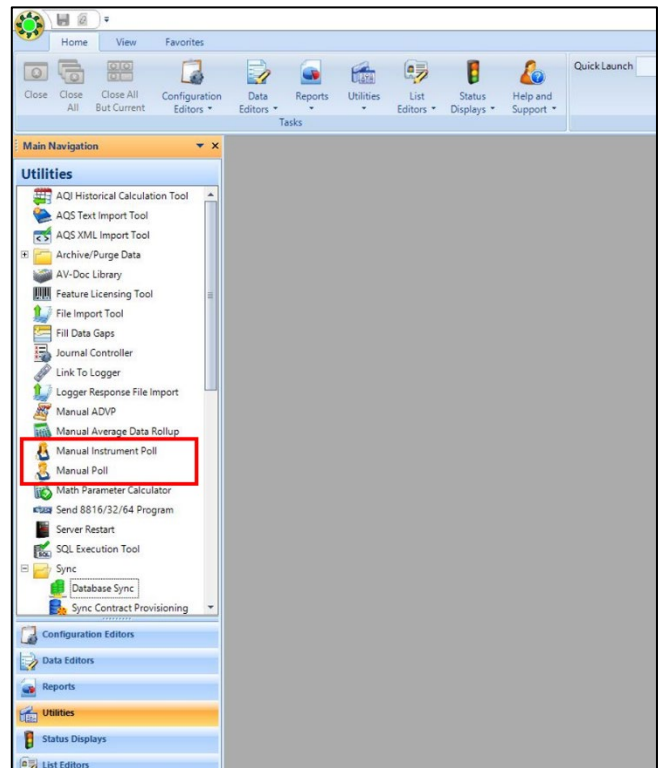


Once the data is loaded, the user can toggle through various presentation options to view the data in different formats. The presentation options are listed in the top bar of the screen and include **Linear Data**, **Cross-Tab Data**, **Matrix Data**, **Time Series Graph**, **Scatter Plot**, and **Histogram**. Historically, operators have used the first four views most often.



Repolling Data

If data is missing from AirVision, the **Manual Poll** and **Manual Instrument Poll** are two built-in options to fill in data gaps from either the 8872 or the instrument. The Manual Poll retrieves data from the 8872, whereas the Manual Instrument Poll retrieves data from *direct polled instruments*. This distinction means that BAMs can be polled via Manual Instrument Poll, but other instruments, such as gaseous analyzers cannot. Data can only be polled from the 8872 *if* the data is present. If data did not report from the instrument to the 8872 due to a power or computer failure, a Manual Poll will not be possible. Both Manual Poll or Manual Instrument Poll will fill in data gaps in the AirVision database and do not overwrite values.



To repoll data from an 8872, users will need to navigate to the **Utilities** menu and select **Manual Poll**. A similar menu to the **Average Data Editor** appears for the **Manual Poll** to select a *site*, *data type*, *date* and *time range*, and *sampling interval*.

To repoll a direct polled instrument, such as a BAM, users will need to navigate to the **Utilities** menu, select **Manual Instrument Poll**, and select the *site*, *instrument* and the *date* and *time range*. When repolling BAM data, select the first **Poll Type** option of **'Poll Averages (1h)'**.

Data Import Requests

If data is missing from AirVision and the Manual Poll/Manual Instrument Poll were unsuccessful, the site operator will need to contact the DEC AirVision Admin group with a data import request, following the procedures outlined in the DEC Data Import Request instructions (*Appendix B*).



To submit a data import request:

- Compose email to dec.aq.agilareadmin@alaska.gov
- Provide .xlsx file containing data that needs to be imported
- In email body outline:
 - Site
 - Parameters
 - If data in AirVision should be overwritten or only fill in missing data
 - Specify if data file is time beginning or time ending

Applying Rules after Repoll

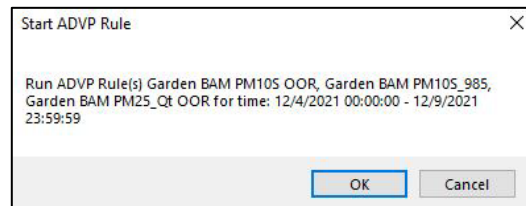
ADVP rules are a scheduled task that runs every hour when current data is imported into the AirVision central server. However, when data is manually polled, ADVP rules are not automatically applied, so a user will have to initiate the rule application. All users can run manual ADVP rules.

To initiate a manual ADVP, users must navigate to the **Utilities** menu, select **Manual ADVP**, and set the *date* and *time range* for which the rule should be applied. Rules can be selected under ‘**ADVP Rule Selection**’. *Note* - most rules are site specific. Site names are listed at the beginning of the ADVP rule name. The current ADVP rules utilized by ADEC are listed in *Appendix A ADVP Rules*).

Once the rules and date/time frame are set, select ‘**Process Selected Rules**’ in the top left corner. **Warning** - Manual ADVP applies to data automatically. There will be no chance to review and ‘undo’ any actions.



A pop-up will appear asking to confirm the start of the ADVP rule processing with the rules and dates/times listed.



Ensure that the details are correct before hitting ‘OK’. If changes are needed, select ‘Cancel’.

As the rules process, a window will appear showing the data the rule is applied to. It is recommended that the user watch the rule apply to ensure that it runs correctly. If an error occurs, there will be a notice. Double-check details and re-run. If no error occurs, a message saying ‘**ADVP processing finished**’ will display. Once it is complete, the data can be retrieved from the **Average Data Editor** and should be double-checked to make sure that the rules were applied to the data correctly.



Changing Calibration Results

Gaseous instruments undergo regular ZPS checks to ensure data accuracy and identify issues in instrument performance. A ZPS check involves sending a standard gas with a known concentration that is certified by an outside laboratory through the sample stream of the instrument and comparing the result to a known standard. The percent difference between the standard and instrument is used to measure the instrument's precision as well as intermittent troubleshooting. Each parameter has its own schedule for ZPS checks (*Appendix C*) that include a variety of automatic (scheduled) sequences along with manually initiated sequences used for calibrations and verifications.

The ZPS checks are built in AirVision to have a duration and response time of each phase. The duration is how long the entire phase takes to run (e.g. how long O₃ at 50.0 ppb should run through sample stream). The response time is the amount of time used for calculating the result of the phase, which is an average of that many minutes (e.g. a response time of 005m will average the last five 001m phases to produce the result of that phase). Since ZPS checks are scheduled and are calculated within the system, site operators need to review the ZPS checks to ensure that they are running correctly and that the results are accurate. If ZPS check results are invalid, out of tolerance, or seem suspicious, the site operator will need to review the data before invalidating the ZPS check or corresponding ambient air data.

Editing and Annotating Data

The data review process for retrieving, reviewing, and analyzing data is the same for all parameters. The specific criteria for invalidating and qualifying data is parameter specific and will be addressed outside of this SOP. Editing and annotating data occurs on the central server (DECJNUAQMON2) and within the **Average Data Editor** for ambient air concentration data. During this process, it is important to remember that if changes are made by accident or if there is uncertainty about what was changed, the user should close the screen (X out) without saving or applying the edits.

Data review should occur on a (nearly) daily basis and, if maintained, will make the monthly data review a relatively quick process. To edit and annotate data, users will need to retrieve data for the specific date/time range, site, and parameter(s) of interest (see Accessing Data Using AirVision). Once data is populated and the **Linear Data View** is selected, users will see five columns that are 'greyed out' and unable to be edited – *Site, Parameter, Average Interval, Date* and *Raw Value*. The rest of the columns are white or color coded because auto-applied flags are editable (Table 2).



Table 2. Column explanations (in Linear Data view)

Column Name	Description
Site	Site name for data retrieved
Parameter	Parameter name for data retrieved. Helpful if multiple parameters are being reviewed at once
Average Interval	Average interval of data that is specified when retrieving the data in Average Data Editor
Date	Date the data was collected.
Value	Final value that will be reported to AQS. <i>This field is editable</i>
Raw Value	Raw value from instrument. This value can never be changed and will always be kept. If a mistake were made that applied to the 'Value' field, data could be restored from 'Raw Value'
AQS Null Code	AQS Null Code applied to data and reported to AQS. <i>This field is editable</i>
Flags	Internal Agilaire flags that are <i>not</i> reported to AQS. <i>This field is editable</i>
Qualifier Codes	Qualifier Codes applied to data and reported to AQS. <i>This field is editable</i>
AQS Method Code	AQS Method Code that is set in parameter settings. Do not modify this field
Data Grade	Data Grade is used by DEC to indicate and track where data stands in the review process (No grade = not reviewed, 1 = reviewed by 1 st level, 2 = reviewed by 2 nd level, 3 = reviewed, finalized and locked by 3 rd level)
Annotations	Annotations shows all notes and actions applied to data. This field can be edited but is also indelible, meaning any changes that are made to a value (row of data) will be recorded and the log cannot be modified

To edit a single data point, click on the cell of interest. For example, to apply an AQS Null Code to a single value, click in the corresponding cell for that value under the **AQS Null Code** header. A pop-up appears for that cell's options for selection of the appropriate value, null code, flag, qualifier code, data grade or annotation.

To edit multiple data points, in the **Value** column, click-and-drag, CTRL+click, or SHIFT+click to select the range of values to edit. Then, right-click and select '**Batch Edit**'. The **Batch Edit**



menu has several options, each of which must be separately enabled on their sub-menus: *Update Values*, *Set Annotations*, *Set AQS Null Code*, *Set Qualifier Codes*, *Set Flags*, *Set AQS Method Code*, *Set Data Grade*. **Batch Edit** is a fast way to apply the same set of edits to a large group of data and to apply different types of edits all at once (e.g. apply an AQS Null Code and Annotation at the same time). Once the box has been checked to enable the desired batch edit function, the functions' sub-menu will change from unavailable to an interactive menu. Apply edits as needed and click 'OK'. The changes will apply to the data. *Note* - be mindful of the time interval and the amount of data selected. The more values edited at once, the longer it takes the system to apply the edits. Once the edits are made, the changes are visible in the **Average Data Editor**. If there is an issue or mistake with the edits, either 'X' out and close without saving or reselect the same data and redo the Batch Edit. Otherwise, if the edits are correct, hit 'Save'.

'**Drill Down**' is a feature that allows the user to further investigate the data by showing the smaller interval data that resulted in that average. For example, if there is a 001h value of CO data that looks suspicious, right-click in the **Value** cell and select '**Drill-Down Interval**' and then choose the smaller interval of interest. This will open a new **Average Data Editor** window with that new time interval shown for the selected parameter and original interval.

'**Show Children**' is available when right-clicking a *Value*. This feature is not available for all parameters but is available for parameters such as PM2.5L or PM10L. This is an easy way to see related data for a parameter in a separate **Average Data Editor** window.

4.2 Monthly Level 1 Review

At the end of each month, site operators will complete a full review of the data collected for each of their sites/parameters. If daily data review has been continuously done and all weekly/monthly maintenance tasks have been completed, this should be a relatively fast process.

Checking Data Accuracy: All Data

All data must be reviewed for accuracy. To start, users will need to open the **Average Data Editor** and retrieve the relevant data including *site*, *parameter*, *date range*, and *sampling time interval*. Level 1 reviewers should first investigate all Agilaire flags applied by the AirVision system. All flags must be removed from valid data and be replaced with appropriate qualifier codes or AQS null codes when applicable (Table 3). All edited, qualified, or nullified data needs to be annotated to indicate the nature of the data integrity issue. In addition to annotating in AirVision, qualified data must be explained in the issues/notes section of the data review sheet (*Appendix D*) to explain any data quality issues and when unsure, qualifier codes are to be reviewed by the Quality Assurance Officer or a supervisor to ensure appropriate and uniform application of qualifiers across the network.



Table 3. Examples of some of the most used AQS null codes (by DEC) for all data collection methods (in alphabetical order) and explanations of when they apply to data. An X under the data collection column means that the code can be used for this method, B = BAM, P = Partisol, G = Gaseous, and M = Met.

Null Code	Code Description	B	P	G	M	When to Use
AF	Scheduled but not Collected		X			Operator is unable to get to site at scheduled date and filter swap doesn't occur
AG	Sample Time out of Limits		X			Sample time exceeded the specification for the sample collection
AI	Insufficient Data (cannot calculate)	X	X	X	X	Data collected was insufficient for valid average
AN	Machine Malfunction	X	X	X	X	General code that is applied when anything goes wrong with instruments at a site
AQ	Collection Error	X		X	X	Issues with data collection with a continuous instrument like less than 75% data capture
AR	Lab Error		X			Issues with laboratory practices before or after deployment like an unstable balance reading
AS	Poor Quality Assurance Results	X	X	X	X	Applied any time there is reason to question validity of data due to poor QA or failing QCs
AT	Calibration	X			X	Continuous PM Calibrations
AV	Power Failure	X	X	X	X	Any power loss issues at a site
AX	Precision Check (Flow checks)	X	X			Continuous PM QC check (flow check)
AY	QC Control Points (zero/span)			X		Only zero and span checks are performed, often done when troubleshooting
BA	Maintenance/Routine Repairs	X	X	X	X	Routine maintenance and repairs like filter and tape changes
BC	Multi-point Calibration			X		Gaseous calibrations such as multi-point calibrations
BF	Precision/Zero/Span			X		Applied when a ZPS check is performed as scheduled or manually run
BJ	Operator Error	X	X	X	X	Assigned by Operator for miscellaneous nullification



Null Code	Code Description	B	P	G	M	When to Use
BL.	QA Audit	X	X	X	X	Applied during audit
DA	Aberrant Data	X	X	X	X	Applied to any unusual data, like negative values that will be rejected by AQS, corrupt files, aberrant chromatography, spikes, shifts, etc.
QV	Quality Control Multi-point Verification			X		During multi-point verification without adjustment
TS	Holding Time or Transport Temperature Is Out Of Specs.		X			Can occur when a filter is not deployed fast enough after initial weight, when final weight is taken too long after initial weight or deployment date, or when holding temp/times exceed specs
TT	Transport Temperature Is Out Of Specs		X			Qualifier code that is applied after discussing circumstances with QA auditor when the TS Null code may not be appropriate

Next, reviewers should review all final data points for any exceedances of the National Ambient Air Quality Standards (NAAQS) or unusual values that should be investigated. The NAAQS will vary by pollutant (<https://www.epa.gov/criteria-air-pollutants/naaqs-table>). Any exceedances or unusually high values must be noted in the “**Issues**” section of the **Data Review Checklist**. This will include aberrant values, values that fall out of the normal range, data associated with maintenance/precision events, or other unusual data. The **Time Series Graph** view enables a quick glance to spot these oddities or unusual trends for all data. It is easiest to de-select all parameters and then view each individually, since the scale will change between parameters. The Level 1 reviewer may also sort the data by “**Cross Tab Data**” and “**Display Null Code**” at the top of the screen. The values may be sorted by clicking in the “**Final Value**” box at the top of the data to identify values at the extreme high or low of the range, and data can be confirmed to have null codes or qualifiers. All issues affecting or potentially affecting data quality or capture must be annotated and summarized in the **Issues/Notes** section at the bottom of the **Data Review Checklist** (*Appendix D*).

Level 1 reviewers will also need to ensure that all supplemental information and materials associated with the month of review have been verified and uploaded to AirVision. All site visits and any maintenance must be logged in the AirVision logbook, which can be accessed by navigating to the **Data Editors** menu and selecting **Logbook Entry Editor**. This allows reviewers to search for existing logbook entries by a specified date range and by site. Any 1-Point QC checks, calibrations, zero air tests, or other work items need to be documented in the respective form (**AV-Docs** should have template forms) and uploaded to the **AV-Docs** library



(found in the **Utilities** menu) and associated with the instrument in the **Asset Tracker** (found in the **Data Editor** menu). This will include the 1-Point QC check in the current month under review and well as the 1-Point QC check for the following month. Additionally, PM monitors will need to have the flow rate values from each 1-Point QC check entered into the **Flow Rate Verification Details** (found in **Monitor Assessments**). Files must follow the naming convention adopted by ADEC to avoid confusion and make searching for documents easier (*Appendix E*). Additionally, all trace standards and calibration certifications must also be imported into **AV-Docs** and **Asset Tracking** and expiration dates confirmed. If a trace standard is within 3 months of expiration, the data reviewer should contact the program manager. It can take several months for some instruments to come back from recertification.

Once all data review has been completed, (see the following sections for specific guidelines on individual parameters) the Level 1 reviewer needs to verify the criteria as found in *QA Handbook Volume II, Appendix D* and complete the criteria section of the **Data Review Checklist** (*Appendix D*). Next, they will initial and date the sign-off section at the top of the **Data Review Checklist** and save it in the G-drive (*G:\AQ\Monitor\Data\Data In review*) in the folder for the specific site with clear indication of the site, parameter, and month of review. Then, they will need to update their progress on the **Data Review Assign Sheet** as, “**Done – Waiting for Comments.**” Finally, they will notify the assigned Level 2 reviewer (as designated in the **Data Review Assignment Sheet**) via email that the data set is ready for their review.

Checking Data Validity: Gaseous

Gaseous data are viewed in the **Average Data Editor** and sorted from large to small. Any values that are large spikes or suspicious must have an annotation, null code (Table 3), or qualifier code indicating validation status. Level 1 reviewers must confirm that scheduled maintenance was completed for the month in review. Any missed maintenance items need to be explained in the **Issues/Notes** section of the **Data Review Sheet**.

The definition of “unusual value” can vary among gaseous instruments. Below is a list of each gaseous parameter and some of the unusual issues that can occur.

O₃:

- Values < -5 ppb invalidated.
- Elevated concentrations should occur during daylight hours. If not, investigate and invalidate.
- Values > 50 ppb need to be investigated to determine if concentrations are due to calibration sequence.

NO/NO_y/NO_y-NO(Diff):

- Values < -5 ppb are invalidated.
- Confirm elevated values are valid by comparing against Ozone or by annotation.



CO:

- Values < -0.02 ppm are invalidated.
- Values > 50 ppm need to be investigated to determine if concentrations are due to calibration sequence.

SO₂:

- Values < -5 ppb are invalidated.
- Check unusual spikes against calibration events, Ozone levels, and annotation.

Checking Data Accuracy: Calibrations

Level 1 reviewers should navigate to the **Reports** menu and select **Calibration Reports** and then **Multi Phase Calibration Report**. Next, select the appropriate date range, including sampling time interval, and select the gaseous parameters of interest. A single parameter will be cleaner and easier to understand, but multiple parameters may be selected for efficiency.

A ZPS (Zero-Precision-Span) check is a 3-point quality control (QC) verification of a gaseous analyzer's accuracy at the top and bottom of the calibration range, and its linearity across that range. The instrument measures a gas standard at three known concentrations that are within the normal range of ambient conditions for the instrument and location: zero concentration (Zero), moderate concentration (Precision), and high concentration (Span)." . Level 1 reviewers will need to review all ZPS checks that occurred in the month and identify checks that are valid and passing, valid and failing, or invalid. A valid passing ZPS check sequence will run completely and is within tolerance in respect to the [QA Handbook Volume II, Appendix D](#). A valid failing ZPS check sequence will run properly *but* the phase averages of the sequence do not meet criteria. The ZPS check should be nullified with the "1F" AQS null code. If the values are not within tolerance, then the data should be nullified in the **Average Data Editor** with an "AS" AQS null code (Table 3) from the last passing ZPS check to the next valid passing ZPS check. An invalid ZPS check occurs when a sequence does not run properly. This does not automatically invalidate concentration data. If the ZPS check is invalid, the check should be nullified using the "1C" AQS null code (Table 3), or as appropriate (see [QA Handbook Volume II, Appendix D](#)). The data associated with the invalid check will not require nullification.

Specific steps for review of calibration data:

- 1) Compare the ZPS check result from the **Multi-phase Calibration Report** to identify if the check is out of tolerance by comparing against the criteria located in the "One Point QC Check" and "Zero/Span Check" requirements. These requirements can be found in the appropriate (O₃, SO₂, CO, NO) *Appendix D* validation template located in *Appendix D* of the [QA Handbook Volume II](#).
- 2) If the reported results fail or seems suspicious, review the minute data for the last five 1-minute periods at the time when each ZPS check phase was scheduled to run.



- 3) To review minute data, open the **Average Data Editor** and set the date and time range for when the ZPS check ran. Make sure to limit the date and time range to the specific range that is of interest. The more data requested, the longer the program takes to respond.
- 4) Once the minute data is posted, review the values and perform an average of the last 5-minute stable period of data. Compare this to the value in the **Calibration Report**. If these values differ, a change to the calibration result can be done.
- 5) Only change calibration results if the value is reported incorrectly (not including small rounding errors that may be present) and the site operator is able to support a corrected value with minute data and/or instrument data. All changes to results must be annotated and logged with an explanation for why the changes were made.
- 6) To make edits to calibration results, go to the **Data Editors** tab and select **Calibration Data Editor**. Set the date and time range to retrieve the appropriate ZPS check.
- 7) Once the data is generated, compare each phase's results to the minute data in the **Average Data Editor**.
- 8) To change a calibration result, click on the cell of interest in the 'Value' column of **Calibration Data Editor** and type in the correct value in that cell. When finished, click **Save**. Regenerate the data and confirm that changes were saved.

Checking Data Accuracy: PM via (FEM) Beta Attenuation Monitors (BAM)

To ensure the accuracy of the AirVision system, Level 1 reviewers will need to compare data collected directly by the BAM instrument to what was recorded in AirVision. Direct download information can be accessed through the Comet2 software on the SNL or through a direct connection to the instrument using a computer with the Comet2 software installed on it. Site operators will download the month of data including error reports, new flow data, and flow stats. They will use information to perform a 10% spot check between data in Agilaire (**Average Data Editor**) and the instrument's direct download. It should be noted that the BAM records (time ending records) will need to be shifted forward by 1 hour to match the AirVision system (time beginning records). When all data review has been completed, the Level 1 reviewer will confirm that the Data Grade 1 has been applied to all concentration data (PM2.5L, PM10L, and PM10S) to indicate that this data has been reviewed and is considered accurate.

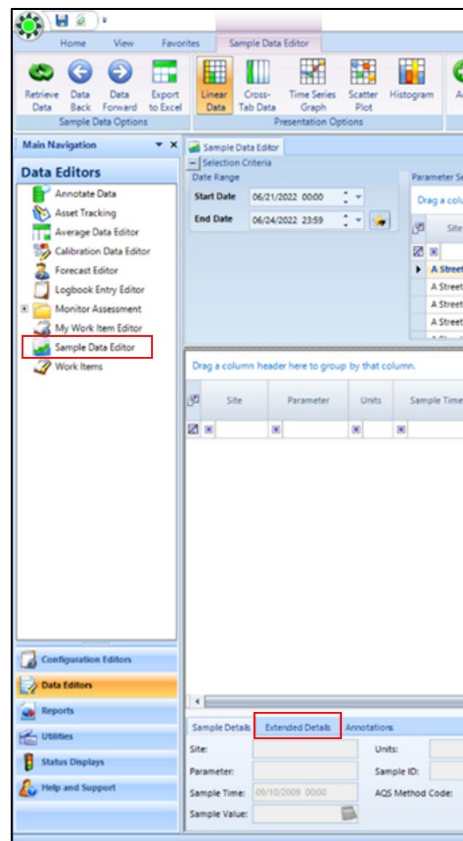
Checking Data Accuracy: PM via (FRM) Gravimetric Partisols

Unlike the continuous samplers, Partisol metadata must be downloaded semi-monthly from the instrument and imported into the Laboratory Information Management System (LIMS). This data will be combined with the corresponding sampler's metadata and filter weights, which are collected and processed by the LIMS, to calculate PM concentrations. Lab operators will



provide a final spreadsheet of all filter data, which is then imported into AirVision and will populate in the **Sample Data Editor** for data review.

Level 1 reviewers will need to retrieve the relevant data including *site, instrument, parameter, and date/time range*. Using the **Filter Field Log** sheets, they will compare the sample metadata parameters between Agilaire and field log sheets, and notify the lab operator of any inconsistencies. To verify the **Filter ID** between the AirVision metadata and the filter field logs, the reviewer will need to click on the concentration parameter since the Filter ID is only associated with the concentration parameter of the instrument. Additionally, the Level 1 reviewer will review filter data for missed samples and verify that each filter passed all validation criteria. If a filter was missed, the Level 1 reviewer will need to notify the lab operator who will create an additional import file with the dates of the missed filters and appropriate null codes. The Level 1 reviewer should count the number of make-up runs, which are sample events that do not fall on an EPA scheduled sample day. There should be no more than 5 makeup runs per instrument per quarter. If there are more than that, then the QA officer and field manager will need to be notified. If a filter failed any of the validation criteria (guidance can be found in the *QA Handbook Volume II, Appendix D*) they will need to apply the appropriate AQS null code or qualifier (Table 3).



Next, the Level 1 reviewer will click on the concentration value and review AirVision flags that were applied to the parameter. These flags should be removed and replaced with appropriate qualifier or null codes where applicable. An annotation should be included with any qualifier or null codes describing why the data received that code. However, during this process the columns for *Frequency Code, Duration Code, or Method Code* should not be changed. If any values need to be edited or changed, contact the primary lab operator. Any edits to the data should be made in the LIMS and then exported into AirVision so that the data between the two programs remain consistent.

With the concentration value still selected and highlighted, the Level 1 reviewer can open the **Extended Details** tab. Here, they will need to populate the **Retrieved Time** field with the date and time the filter was retrieved from the field. This date and time should be found using the electronic logbook entry documenting the site visit as well as the filter field log. Next, they can verify the retrieval time criterion, pre-sampling criterion, and post-sampling criterion by



selecting **Sample Delay Filter** tabs at the top of the screen, or by verifying the number and color of the *Pickup Delay* and *Analysis Delay* columns in the **Linear Data** tab. The Level 1 reviewer should also look at the mass difference values of the field blanks. If it is greater than 30 micrograms (μg), it should be investigated further for possible causes and discussed with the lab operator and QA officer.

For collocated samplers, the Level 1 reviewer can run a **Sample Hourly Daily Comparison Report** for the samplers of concern and the appropriate date range. This report can be exported as an Excel file to determine the *Coefficient of Variance (CV)* between matched samples. Only samples whose concentrations are above $3 \mu\text{g}/\text{m}^3$ should be included for collocation comparison.

Daily/Weekly Meteorological Data Review

For sites that collect meteorological (met) data, Level 1 reviews will be completed by the site operator, and Level 2 reviews will be completed by the Air Monitoring and Quality Assurance program (AMQA) Meteorologist. Since this is not the direct area of expertise for most site operators, the different met data parameters will be discussed in detail in this section

Level 1 reviewers should review all met data at the **5-min time interval** by using the **Average Data Editor** tool for the date range of interest. They should identify any ADVP generated flags which will be applied to data with wind speeds below 0 meters per second (mps) and wind directions above 360° and evaluate the reasons for the flag. Where appropriate, AQS null codes should be applied to invalidated data and have an associated annotation added to explain the change.

When looking at the data in **Average Data Editor**, it can be helpful to switch to the **time series graph** view to look for outlier data that will need nullification or flagging. If data appears to be tracking normally (Figure 3), no additional evaluation is needed.

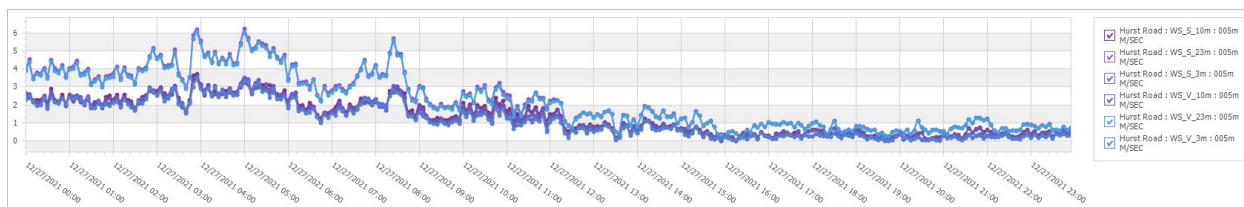


Figure 3. Daily wind speed example where the scalar and vector wind speeds at each height for Hurst are tracking normally, data would be considered valid, and no further evaluation would be needed.

However, if the graph shows anomalies, they should be further investigated. The Level 1 reviewer will need to investigate the reason for the anomalies and nullify and annotate the data as needed. Level 1 reviewers should investigate any wind speed spikes that are greater than 6-



10 mps in a 5-10 min period, or long periods of time with no change in wind speed (Figure 4). They should also investigate time periods where data is missing from the report (Figure 5). If possible, they will need to look for the missing data and import it into the AirVision system.

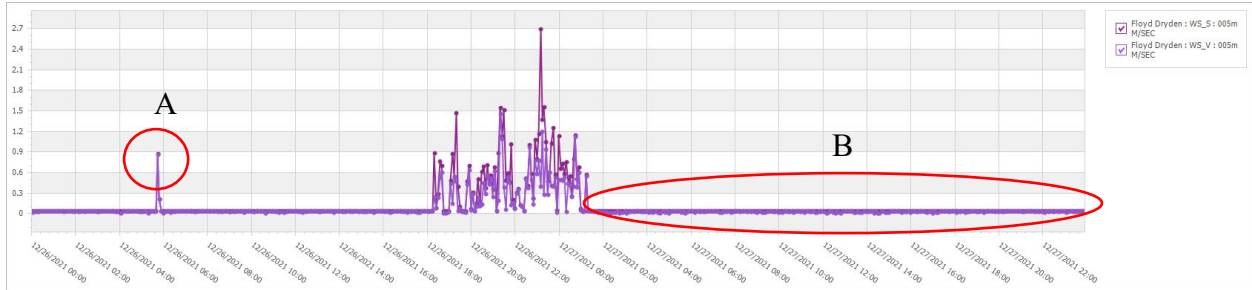


Figure 4. Example aberrant wind speed data. (A) Indicates a spike in wind speeds. Generally look at spikes greater than 6-10 mps in a 5–10 min period. (B) Could be an example of a frozen sensor or incorrect configuration in the sensor settings.

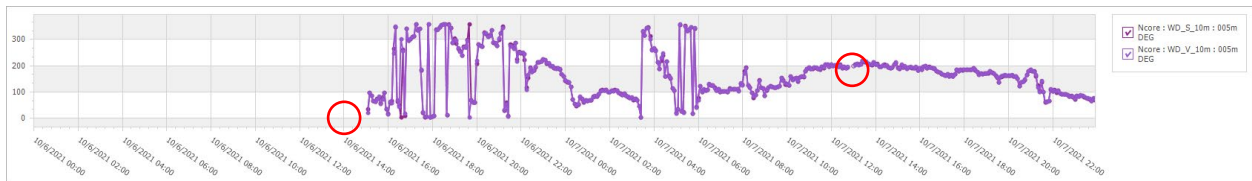


Figure 5. Example of missing data in the wind direction time series graphs. The red circles above identify time periods of missing data.

With the passing of a frontal system, wind direction tends to be flat and uniform ahead of the front, and then the wind direction will shift as the front passes (Figure 5). During an inversion or high pressure, wind directions will look very sporadic (Figure 6).



Figure 6. Example of wind directions during a weather system.

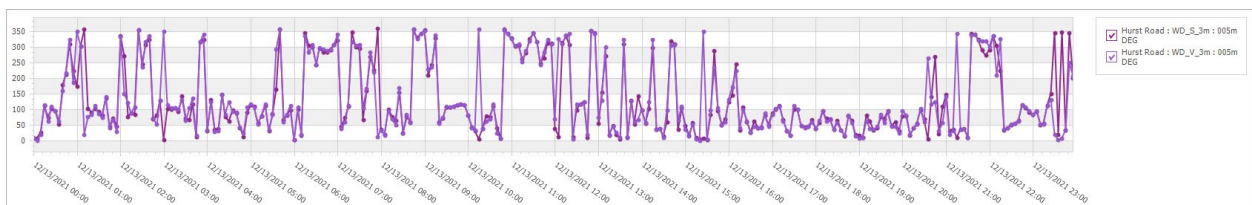


Figure 7. Example of wind directions during an inversion.



Similar to the analysis of wind speed/direction, it is easiest to evaluate daily temperatures by viewing the data as a time series graph in the **Average Data Editor**. Level 1 reviewers should investigate any temperature spikes and missing data in the time range of interest. If missing data is unavailable for import, they will need to nullify all missing data (Figure 8).

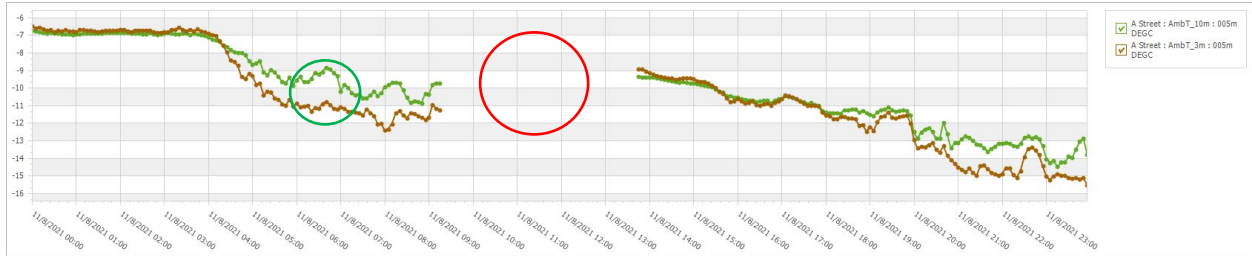


Figure 8. Example of missing data on a temperature time series graph where missing data is shown in the red circle. The small green circle shows a normal separation between the 3m and 10m temperature profile during a surface inversion.

If a site has temperature sensors located at various heights, they will typically track each other, i.e. follow the same pattern. However, there are times when a normal separation between sensors is observed (Figure 8.). The Level 1 reviewer should look at the whole graph and confirm that all sensors are roughly following the same pattern. If the temperature values begin to diverge in opposite directions, they will need to investigate further. Figure 9 shows an example of a temperature spike that can occur during a voltage surge. All spikes should be investigated and flagged.

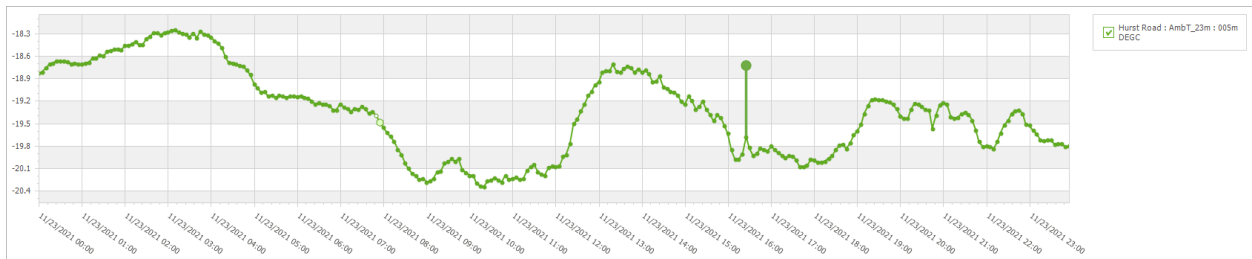


Figure 9. Example of spikes seen in the temperature profile.

Met Sensor Supplemental Documents

When replacing met sensors, including temperature probes, sonic anemometers, propeller anemometers (windbird), and relative humidity (RH) probes, the site operator will need to upload copies of the new factory certifications to the **AV-Doc Library** and link them to the correct instrument in the **Asset Tracking Data Editor**. The certifications can also be attached to the log entry that was created during the instrument swap, but it is not a requirement. As a final step, a copy of the certification should be e-mailed to the AMQA Meteorologist.



Lowering of any Tower with Met Sensors

When the site operator needs to lower a tower with met sensors, they will need to make sure that this is clearly described in a logbook entry. The Level 1 reviewer should make sure that all data associated with the time frame in which the tower was lowered should be nullified with the “BA” AQS null code. Lowering the tower to work on 10 meter (m) sensors does not require that the reviewer annotate or invalidate any of the 3 m met sensors.

4.3 Level 2 Data Review

The data review process can be an iterative process with multiple rounds of edits between the Level 1 and Level 2 reviewers (Figure 2). However, the Level 2 review should not involve an exhaustive replication of the original Level 1 review. The intention of Level 2 data review is only to confirm the consistency and accuracy of the Level 1 data review (as described in the previous section).

Generally, the Level 2 reviewer will start by reviewing the Data Review Checklist for completeness and accuracy. This will orient them to the specific data quality requirements for the instrument (helpful since many Level 2 reviewers are not site operators) and alert them to any issues that may have occurred during the month under review. It is also a good idea to review the completed maintenance items since they indicate which documents should have been uploaded to **AV-Docs** and marked in the maintenance schedule. There is no prescribed order for Level 2 review process. However, there are specific responsibilities that must be completed in a Level 2 review.

Level 2 reviewers shall confirm that logbook entries are present and reasonably detailed in AirVision. Data entries need to provide enough detail to explain what occurred at the site during each visit. The date of logbook entries and the worked detailed must mirror the flagging and annotations seen in the **Average Data Editor** tool.

They will review all documentation accompanying work done in the month for accuracy and ensure that the documents have been uploaded to **AV-Docs** and attached to the instrument in **Asset Tracking**. Level 2 reviewers should pay particular attention to the date/times on the various forms since copy/paste errors and reusing of old forms can lead to common mistakes. Additionally, they will confirm that the instrument’s information and the site operator listed are correct. Finally, they will review the results and confirm passing/failing values and any work items detailed in the forms.

For continuous instruments (gaseous, BAMs, met, and T640x) the Level 2 reviewer will review the data in the **Average Data Editor**. In particular, they will confirm qualifiers, nullification, and annotations. This may involve reviewing logbook entries to confirm that the correct nullification code was used to maintain consistency across sites and(or) site operators. They must verify that all automatic flagging, null codes and qualifiers have been applied correctly



and have been annotated. Additionally, they should confirm that any exceedances should be annotated with a known cause and any aberrant negative values that fall outside of acceptable range (see AQS Sampling Methods for specific parameter limits, <https://www.epa.gov/aqs>) should be nullified. For gaseous instruments only, the Level 2 review will ensure that all ZPS checks and other calibration sequences meet criteria and concentration data is nullified where appropriate.

For gravimetric instruments (Partisols), the Level 2 reviewer will assess the data in the **Sample Data Editor**. Start by reviewing the collection dates (under **Sample Time**) for the Partisol samples against the EPA sampling schedule (<https://www.epa.gov/amtic/sampling-schedule-calendar>). This should match the **Frequency Code** in AirVision. Confirm that missed filters are accounted for with the appropriate null code and that makeup runs are identified. Also, confirm field blank dates and note the amount of time between field blanks. One field blank should be collected every ten filters. Missing this frequency is not grounds for nullification or qualification of data, but it should be noted since the field blanks are used as a diagnostic tool to measure instrument drift and other externalities that could impact data quality. Confirm that any missed sample days are included with an **AF** (scheduled not collected) null code. Missed samples should be added to the AirVision import file for each sampler so all associated parameters show as nullified data. The Level 2 reviewer will look for makeup samples, which are samples that did not run on a scheduled sample day. These samples should have a note explaining that they are a make-up run. Only two (2) will count towards completion and only five (5) are allowed in a quarter. Look for any other null or qualifier codes and confirm that the correct code was applied and that there is an explanation in the field logbook or data. Next, they must verify that all automatic flagging, null codes, and qualifiers have been applied correctly and have been annotated. Next, the Level 2 reviewer should open the field logs from **AV Docs** and confirm that filter ID numbers (only associated with the concentration parameter) are correct. They should also confirm that the manually entered retrieval time matches what's recorded in the field logs. After verifying that the information is correct in the system, then the Level 2 reviewer can use the **Sample Delay** filters in the **Sample Data Editor** menu to highlight any filters that may have exceeded the filter pick-up time or time to final weight (analysis) to verify that any true exceedances have been qualified/nullified, as appropriate.

Finally, the Level 2 reviewer will respond to any issues, comments, NAAQS exceedances, or exceptional events in the **Notes** section of **Data Review Checklist**. If no specific response is required, they should add the statement "*Noted*" to acknowledge they have read the comment. Any responses should follow the font color scheme that is outlined at the top of the data review sheet in order to avoid confusion on authorship. Additionally, comments or questions that will require further discussion or follow-up should be copied and pasted into the email message sent to the Level 1 reviewer.



Upon completion, the Level 2 reviewer will need to update their progress on the **Data Review Assign Sheet** by writing “*Done – Waiting for Comments*”. Send a notification email to the Level 1 reviewer and CC the Level 3 reviewer, Data Manager, and QA Officer. The Level 1 reviewer will respond to all of the Level 2 reviewer’s comments and questions. This process could take several iterations depending on the issues being addressed in the review. Once all comments and concerns have been addressed and resolved, the Level 2 reviewer will sign-off on the **Data Review Sheet**, apply a **Data Grade 2** to all concentration data, update their progress on **Data Review Assign Sheet** as, “*Complete*”. Once the review is complete and ready for Level 3 review and AQS submission, send a notification email to the Level 1 reviewer, Level 3 reviewer, Data Manager, and QA Officer.

4.4 Level 3 Review (Final Validation)

Upon satisfactory completion of the Level 2 review, the reviewer will notify the Level 3 reviewer, QA Officer, and program manager that the data is validated for Level 3 review and AQS submission. This can be verified by checking that both the Level 1 and Level 2 reviewers have marked the dataset as complete (dark green font color) in the **Data Review Assignment Sheet**. The Level 3 reviewer will do an independent, final review of the data to prepare for AQS submission. They will also review QC data, including 1-Point QC checks (BAMs and Partisols), 1-Point Precision Checks (gaseous), and any audits conducted during the review period.

At this level, the Level 3 reviewer will not confirm that all Level 1 review tasks have been completed, and they will not analyze the data for trends. Instead, this review will focus on major issues that would affect AQS submission and data completeness, most of which have been outlined in the previous Level 2 Review section. The Level 3 reviewer will look for any data that will be rejected by the AQS system. Some of the most common issues are listed in Table 4.

Table 4. List of common issues that will cause AQS to reject data that are encountered in Level 3 review. They all require follow up with site operators and updates before data submission.

Issue	Common Examples
Values that fall outside of accepted limits	PM10L/PM2.5L < -10 µg/m ³ , and PM10S < -5 µg/m ³
Error codes or missing values	985 code in BAM
AirVision Flags that nullify data in AQS report	<," "?," "I," and "T"
Partisol lab issues that may nullify data	validity rating > 0, unstable balance lab note



For gaseous data only - after reviewing all QC/ZPS checks to ensure that all failing and invalid checks have been identified, the Level 3 reviewer will navigate to **Calibration Data Editors** from the **Data Editors** menu and will select a site/parameter and desired date range then click **Retrieve Data** (very top left of screen). Then, using the ZPS report as a guide, they will assign failing valid ZPS checks a **1F** AQS null code and invalid ZPS checks a **1C** null code (Figure 10).

Calibration Data													
Site	Parameter	Sequence	Phase	Start Date	End Date	Value	Expected Value	Exclude From Reporting	Tracer ID	Level	Method Code	AQS Null Code	
Ncore	O3	O3_ZPS	Span	12/02/2021 03:00	12/02/2021 03:15	126.849121	120	<input type="checkbox"/>	0	SPAN	47		
Ncore	O3	O3_ZPS	Precisio	12/02/2021 03:00	12/02/2021 03:30	53.2140169	50	<input type="checkbox"/>	0	PREC	47		
Ncore	O3	O3_ZPS	Zero	12/02/2021 03:00	12/02/2021 03:45	0.150857558	0	<input type="checkbox"/>	0	ZERO	47		
Ncore	O3	O3_ZPS	Span	12/05/2021 03:00	12/05/2021 03:15	125.506496	120	<input type="checkbox"/>	0	SPAN	47		
Ncore	O3	O3_ZPS	Precisio	12/05/2021 03:00	12/05/2021 03:30	53.6275	50	<input type="checkbox"/>	0	PREC	47		
Ncore	O3	O3_ZPS	Zero	12/05/2021 03:00	12/05/2021 03:45	0.568135463	0	<input type="checkbox"/>	0	ZERO	47		
Ncore	O3	O3_ZPS	Span	12/05/2021 11:31	12/05/2021 11:46	124.807569	120	<input type="checkbox"/>	0	SPAN	47		
Ncore	O3	O3_ZPS	Precisio	12/05/2021 11:31	12/05/2021 12:01	53.1807769	50	<input type="checkbox"/>	0	PREC	47		
Ncore	O3	O3_ZPS	Zero	12/05/2021 11:31	12/05/2021 12:16	-0.04913802	0	<input type="checkbox"/>	0	ZERO	47		

Figure 10. Screenshot of Calibration Data Editor in AirVision.

Gravimetric (Partisol) PM filter run dates will be compared to the EPA sampling schedule (<https://www.epa.gov/amtic/sampling-schedule-calendar>). If a filter run date is missing, it will need to be added to the data set with the date and a “*scheduled but did not run (AF)*” null code. The Level 3 reviewer may have one final look at the Partisol meta-data to look for anything that could invalidate a filter that may have been missed

The Level 3 reviewer may need to reach out to the site operator and/or Level 1 reviewer, Level 2 reviewer, or QA Officer to answer questions about any unusual data. If there are mistakes in the data, time permitting, the Level 1 reviewer should make any needed changes in **AirVision** or other files used to generate AQS submission data. Once the Level 3 review has been completed and all data has been updated, the concentration will be assigned a data grade 3 and the AQS submitter will be notified that the data is ready for AQS submission. Once the data is assigned a data grade 3, it will be locked from further editing. This helps to ensure that the data submitted to AQS will match the data in the AirVision.

4.5 EPA Air Quality Subsystem (AQS)

Among other uses, validated data will be used by Air Quality management to inform program policy and create pollution control strategies. Criteria pollutant data will be used by the EPA to determine attainment status regarding the NAAQS. Continuous and semi-continuous data, validated filter-based and other manual method data, and all relevant QC data that has been through the Level 3 validation process are loaded to AQS via flat files. Flat files store data in a plain text format with one record per line of text. Each piece of data associated with a record is



delimited by a bar (or “pipe”). All AQS flat files follow the same format and includes Transaction type (Raw Data) | Action indicator | State | County | Site ID | Parameter | POC | Duration | Units | Method | Sample Date | Sample Time | Sample Value | null or qualifier codes | Frequency (optional) | Monitor Protocol ID (optional) | and ten additional fields (delimited by bars 17-26) allocated for data qualifiers.

An example AQS flat file record:

RD||02|090|0040|61102|1|1|014|061|20190701|01:00:00|207||||||||||||

Currently, continuous and semi-continuous data from BAMs, gaseous instruments, and 1-Point Precision Checks from gaseous QC data is converted into flat files in AirVision using the AQS 2.2 Text Report function. All data from Partisol instruments, 1-Point QC Flow Rate Verifications, and Audit reports is converted to flat files using Excel. In Appendix E, Tables E-1 and E-2 identify all files currently being uploaded to AQS. Files are all saved on the G drive (G:\AQ\Monitor\Data\AQS Archive Data) in a folder designated for that year. All flat files, regardless of provenance, are saved in text format and uploaded to AQS through the Exchange Network Service (ENS) platform. Submission files can contain multiple sites and/or analytes if they are smaller than the maximum upload size of 1 GB in the ENS system. Beyond that, it is up to the AQS submitter to parse data submission files. It can be advantageous to load large files (for example, all PM data with 8000+ records) since this minimizes the total number of files submitted through ENS. In theory, this could save a great deal of time. However, a major disadvantage to loading larger files is that if a common error occurs during submission, there may be thousands of error records to read through in the AQS Load Error Report.

HISTORY AND STATUS							LOAD			POST		
Submission Date	File Name	User Name	Records In File	Date (last)	Process Status	Recs Loaded	Recs Not Loaded	Stat/CR Finding Count	Records to Post	Skip'd Monitors	Records Posted	
20211227 19:45	2021 Q3 Partisol PM25_Met	RACHEL MILLS	3570	20211227 21:20	POST-COMPLETED	3570	0	0	0	0	3570	
20211227 20:13	Corrected 2021 Q3 FB PM10	RACHEL MILLS	51	20211227 20:14	LOAD-ERROR	4	47					
20211227 19:44	2021 Q3 Partisol PM10_25 F	RACHEL MILLS	51	20211227 19:44	LOAD-ERROR	0	51					
20211227 19:43	2021 Q3 Partisol PM10 8110	RACHEL MILLS	100	20211227 19:43	POST-COMPLETED	70	30	3	0	0	70	

Figure 11. Screen shot from Batch (Load) menu in AQS. Flat files will be loaded to the AQS system (Recs Loaded column). Any file that does not meet the AQS criteria will fail to load (Recs Not Loaded column) and will require investigation via the Load Summary and Error Report. In this example, you can see that 30 of the Partisol PM10 records were not loaded (and posted) into AQS.

Any data that fails to load into AQS must be investigated and fixed before it can be reloaded (Figure 11). The Load Summary and Error Report will identify each record that failed to load and provide the reason. Sometimes this is a simple error, such as a unit that needed to be changed, but other times this may involve reaching out to the site operator to recheck data, investigate the correct null code to apply, or check the file used for the upload. Load errors can be corrected in the AQS system or the flat file can be resubmitted with the corrected data. To avoid some of the common load errors, it helps if the AQS submitter confirms the methods,



units, and instruments associated with each parameter being submitted before starting the submission process. Any changes should be made in the methods section of the AQS system and will need to have the correct active date range to enable loading and posting. In addition, the AQS submitter will need to update the **AirVision** system to match AQS.

Once all validated data files have been reported to AQS, the data submission can be verified by running the **AMP251 Raw Monitor Assessment Report** and the **AMP430 Data Completeness Report** in AQS. Reports should cover all parameters in Alaska (not just criteria, which is the default selection in AQS) monitored by DEC. The **AMP251** report will only tell what has been submitted to AQS. It is up to the submitter to review this list by site and parameter to confirm that all files during the designated time period were submitted. The **AMP430** report will provide a summary of the data submitted by site and parameter for each month. It will also include a data completeness breakdown for each month and quarter. Any parameter that failed to meet monthly/quarterly data completeness of 75% or higher should be investigated. The submitter should note what caused the drop in data capture as well as the actions taken to correct the issue.

The AQS Submitter will write a letter to the EPA Region 10 Quality Assurance Coordinator and CC the EPA Region 10 Senior Air Monitoring Specialist, AMQA Program Manager, QA Officer, and Field Operations Manager when data submission is complete. An explanation should be provided if data capture was below 75%. If there is any data that was not submitted on time, it should also be addressed in this letter along with an estimate of when the data will be reported to AQS. The signed letter and copies of the AMP251 and 430 reports (all saved as PDFs) will be emailed to all recipients on or before the quarterly submission deadline.

AQS data are certified annually by May 1st of the year following the ambient monitoring. During this process, the following are reviewed again to confirm that they are within EPA stated limits:

- raw data (summary statistics, collocation, completeness and consistency with local data)
- 1-point and flow rate QC checks and audits (completeness, bias and precision)
- precision and bias (collocations, SLAMS audits and NPAP audits)
- QAPP (approved and current)

Discrepancies between the AQS raw and local data will be corrected as necessary. Missed QC's will be added and any other corrections required are to be done before certification. Notes are added to AQS to document any agency shortfalls to the EPA requirements. State and local agencies only recommend against certifying when the weight of evidence is great enough. Once DEC sends the annual certification letter and EPA concurs with the certification, the data are finalized in AQS and become fully trustworthy for use by the public and government agencies. Changes to the data after certification will require recertification.



4.6 Chemical Speciation Network (CSN)

DEC AMQA is responsible for Level 2 data validation for two CSN sites: NCore in Fairbanks and Hurst Road in North Pole. CSN filters are shipped to the field operators by Wood Labs, deployed and collected by AMQA operators, and shipped with chain of custody (COC) sheets and field notes to UC-Davis (UCD) (*Appendix F*). Sample analysis is completed via a joint effort between UCD and the Desert Research Institute (DRI). DRI is responsible for ion and carbon analysis, and reports their data to UCD, which handles data processing, initial data validation, and loads the data into the **Data Analysis and Reporting Tool (DART)** for final review by AMQA staff. The CSN data validator (DEC data analyst) reviews the data in DART (<https://dart.sonomatech.com/login>) within 30 days of receipt of an email from DART indicating the data is ready for review. The DEC site operators conduct monthly QC (flow) checks for quality control, and the instruments are audited semiannually (flow). The information for these QC checks is saved in AirVision for each instrument in the Asset Tracking screen. The QC checks are manually translated into a flat file for AQS submission.

More information regarding the CSN data validation process, including details on the Level 1 review conducted by UCD, qualifier codes, and links to further resources are available in the CSN Data Validation Guide (https://airquality.ucdavis.edu/sites/g/files/dgvnsk1671/files/inline-files/ValidationGuide_v2.0_update_20190916_0.pdf).

AMQA reviewers who have not previously used DART will be required to request a new account. After opening the DART homepage, navigate to the login page and select the “**Request a DART Account**” option (Figure 12). Complete the sign-up form, selecting “**State of Alaska DEC**” as the agency. DART will then prompt the user to complete the sign-up process by verifying the account via a confirmation email. Once the sign-up process is complete, the reviewer will need to contact their supervisor to request validator permissions to be able to review data.

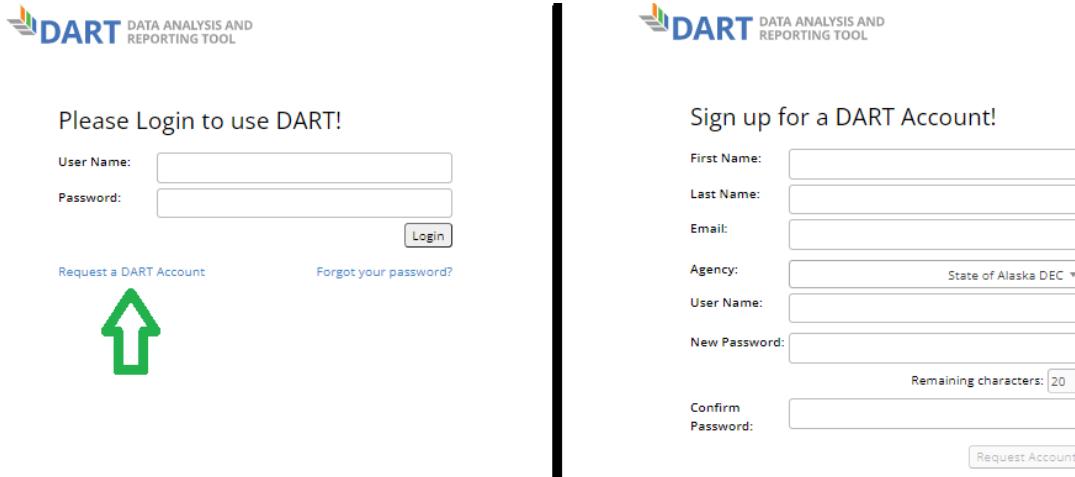


Figure 12. DART Login & Account Sign-Up Page.

Upon logging into DART, all recent **State of Alaska DEC Data Sets** will be displayed (Figure 13). The AMQA data reviewer can then download a copy of the data set or click on the icon under “**Approval Status**” to enter the approval interface for the specified batch of data. Downloading the data is not typically required, as the DART interface allows for efficient review of the data from the operator’s web browser. However, downloading the data may be helpful in circumstances that necessitate the reviewer to conduct statistical analysis beyond the limited statistics package available within DART.

State of Alaska DEC Data Sets

Date Received	Type	Data Set Name	Date Range (LST)	Data Status	Download	Approval Status
07/17/2020	Lab - CSN	020904103 CSN Data	12/03/2019 - 02/04/2020	Ready for use		
08/14/2020	Lab - CSN	020904101 CSN Data	02/14/2019 - 03/10/2020	Ready for use		
02/25/2022	Lab - CSN	020900034 CSN Data	11/02/2013 - 10/30/2021	Ready for use		
02/25/2022	Lab - CSN	020900035 CSN Data	07/31/2019 - 10/30/2021	Ready for use		

Show 10 entries Showing 1 to 4 of 4 entries Previous 1 Next

Figure 13. DART Home Page displaying available datasets.

The batch approval interface allows the AMQA reviewer to view, nullify, qualify, and annotate the DART data. The first section displayed on the approval interface is the “**Batch Summary**” (Figure 14) which displays the date of each sample event within the chosen batch of data.



BATCH SUMMARY				
Total Samples:		Total Qualifiers:	Total Null Codes:	
11		4 (36) 5 (43) MD (295) TT (92)		
Status	Date	Total Qualifiers	Total Null Codes	Action
100%	Oct-01	26 (MD)	0	...
100%	Oct-04	29 (MD)	0	...
100%	Oct-07	46 (TT MD)	0	...
100%	Oct-10	46 (TT MD)	0	...
100%	Oct-13	25 (MD)	0	...

Figure 14. Batch Summary menu, with several sample events listed.

If a sample event did not occur on the scheduled date, the date can be corrected by selecting the appropriate ellipsis button under “**Action**” for the desired sample event. Doing so will open the “**Edit Date**” menu (Figure 15), where the reviewer can apply the corrected date, and select from preset comment options or apply custom comments. DART managers will create missed sample events in order to track data completeness according to EPA Sampling Scheduled events.

Edit Date
✕

Please note that no date changes will be performed by DART. A comment with the date change information will be applied to the selected data. Date changes will be processed by the laboratory.

Selected Date to Edit: 2021-10-01
 Correct Date:

Date change applies to all parameters (analytical and operational) for the selected filter(s):

POC:

Comment to be applied to the selected data:

Custom

The actual run date was not properly recorded on the field sheet, but it has been confirmed with the site operator and available data files that the filters were run on 2021-10-01.

No additional flags or null codes need to be applied, nor do any need to be removed.

Comment preview:

The date for selected filter(s) [please choose above] needs to be updated from 2021-10-01 to 2021-10-01 because...

The actual run date was not properly recorded on the field sheet, but it has been confirmed with the site operator and available data files that the filters were run on 2021-10-01.

Figure 15. Edit Date menu.



The second section on the DART approval interface is the “Batch Data” menu (Figure 16). By default, all data points for the selected batch are displayed; it is possible to display data from a single sample event by clicking on the desired sample event in the “Batch Summary” menu.

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Oct-01	Aluminum PM2.5 LC	5	0.02237	60	0.03202	0.01985	ug/m3		MD	
<input type="checkbox"/>	Oct-01	Ammonium Ion PM2.5 LC	5	0.10183	48	0.01289	0.01348	ug/m3			
<input type="checkbox"/>	Oct-01	Ammonium Nitrate PM2.5 LC	5	0.34164	57	0.04628	0.03381	ug/m3			
<input type="checkbox"/>	Oct-01	Ammonium Sulfate PM2.5 LC	5	1.17974	57	0.00128	0.06383	ug/m3			
<input type="checkbox"/>	Oct-01	Antimony PM2.5 LC	5	0.01265	78	0.01695	0.01078	ug/m3		MD	
<input type="checkbox"/>	Oct-01	Arsenic PM2.5 LC	5	5.0E-5	82	1.0E-4	6.0E-5	ug/m3		MD	
<input type="checkbox"/>	Oct-01	Average Ambient Pressure for URG3000N	5	<input type="text" value="729.6"/>	5	null		mmHg			
<input type="checkbox"/>	Oct-01	Average Ambient Temperature for URG3000N	5	<input type="text" value="0.3"/>	36	null		°C			
<input type="checkbox"/>	Oct-01	Avg Ambient Pressure for MetOne SASS/SuperSASS	5	<input type="text" value="730.0"/>	5	null		mmHg			

Select All A box around values indicate they can be edited by the reviewer.

Figure 16. Batch Data menu with several parameters loaded.

Null codes, qualifier codes, and comments can be applied to the batch parameters by selecting the button under the corresponding column for each parameter. Note: if the AMQA reviewer is going to apply null codes to DART data, the qualifier codes MUST be cleared or deleted, prior to applying null codes. Most parameters are not available for edits by the AMQA data reviewer, as the values are determined during the filter analysis conducted by the UCD team. Field parameters including *average temperature*, *average ambient pressure*, *flow coefficient of variance (CV)*, and *sample volume* are parameters that can be modified if a discrepancy is identified between the DART data and sample event field sheets for Met One Speciation Air Sampling System (SASS) and URG© 3000N instruments.

Clicking on a parameter in the **Batch Data** menu will load all data points for the parameter into the “Time Series” menu (Figure 17). This can also be accomplished by clicking the “+” button on the top left side of the **Time Series** menu, which allows the user to select multiple parameters for comparison. The chart icon located below the “+” button also allows the user to display useful statistical data for the selected parameters, including the mean, median, standard deviation, min/max, and percentiles.

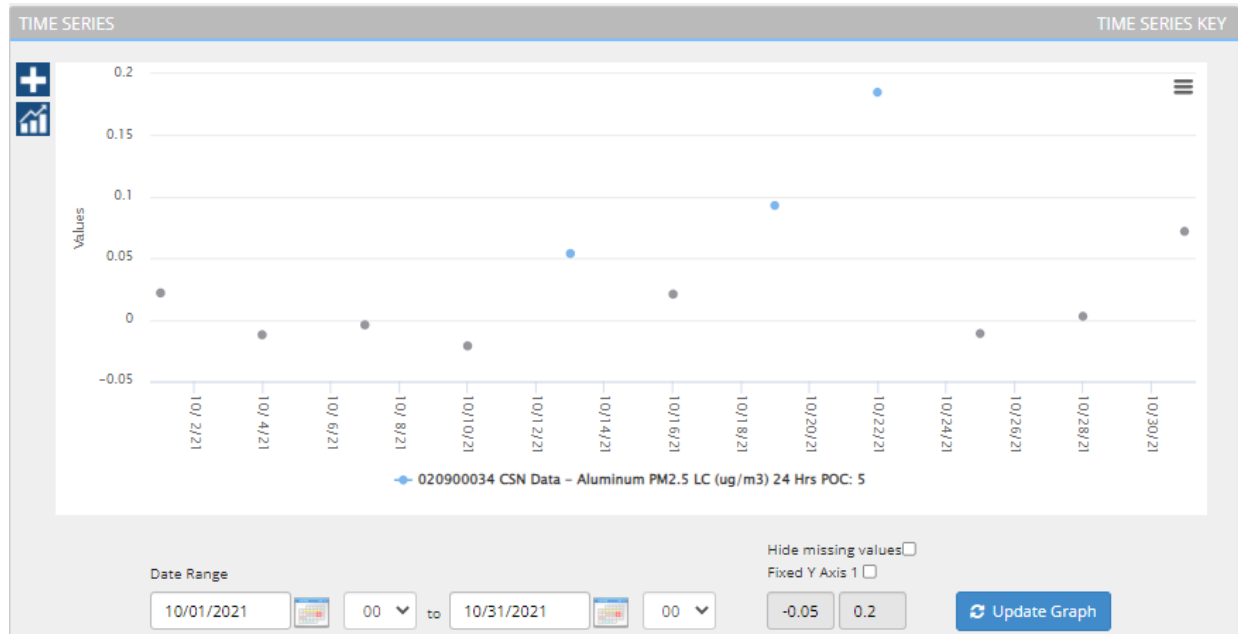


Figure 17. Time Series menu with data points for a single parameter graphed.

The AMQA data reviewer should complete the following:

- Verify that sample event dates are correct in **Batch Summary** menu and correct the dates if any discrepancies are found.
- Review and respond to comments from UCD or lab staff and apply null & qualifier codes as appropriate. Verify that comments recorded by the field operator on the COC sheets have been accurately applied to the respective data.
- Verify that *average ambient pressure*, *ambient temperature*, *flow CV*, and *sample volume* for each filter match the values recorded on the SASS & URG COC sheets. Discrepancies can be corrected by updating the parameter values in the **Batch Data** menu, and any changes should be noted in the parameter comments.
- Verify that data for each parameter is present for each sample event or has been appropriately nullified (or otherwise addressed). The **Time Series** menu is often helpful for quickly identifying if there are missing data points for a parameter, as it will graphically display all parameter data by sample event date for the batch.
- Verify that any invalid samples have been appropriately nullified.
- Verify that there are no anomalous data points for each parameter. The **Time Series** menu, especially when utilizing the statistical data options, is an efficient way to identify outliers. Outliers should be qualified with a '**5 – Outlier**' qualifier code. Before applying an outlier qualification, verify the anomalous nature of this data-point because naturally occurring seasonal events may validate the datapoint, (i.e. wind-blown river-



dusts, forest fire smoke, high particulate days, etc.). Readings from other site instrumentation may be helpful in determining the validity of datapoints.

- Utilize the **scatter plot** tool to compare and verify the linearity of the ‘*Sulfur PM2.5 LC*’ & ‘*Sulfate PM2.5 LC*’ parameters. The sulfur concentrations are automatically scaled by a factor of 3.0 in DART. When plotted against sulfate concentrations, the data points should not deviate significantly from the resulting linear regression model (Figure 18).
- Verify that the **Method Detection (MD)** qualifier codes has been applied to all parameters with values less than their stated **Method Detection Limit (MDL)**. The MDL for each parameter is listed in the **Batch Data** menu.
- Identify any recurring issues and annotate, nullify, or qualify the data accordingly.
- Identify any other trends in the data and annotate the data or apply null/qualifier codes as necessary.
- Once the review of a parameter is complete, the corresponding “**reviewed**” checkbox (found in the **Batch Data** menu) should be selected, and the “**Mark Reviewed**” button should be clicked to apply the changes.
- Verify that monthly 1-point QC checks, calibrations, and maintenance items have been completed in accordance with the CSN SOP and the appropriate forms have been uploaded to AirVision **Asset Tracking**.
- Apply null or qualifier codes as appropriate if maintenance and QC criteria were incomplete or failed.
- Verify that the COC sheets have been scanned and uploaded to AirVision **Asset Tracking**.
- Field blanks are not reported in the DART database, but the reviewer should verify that the field blank COC sheets have been included with the COC upload to AirVision **Asset Tracking**.

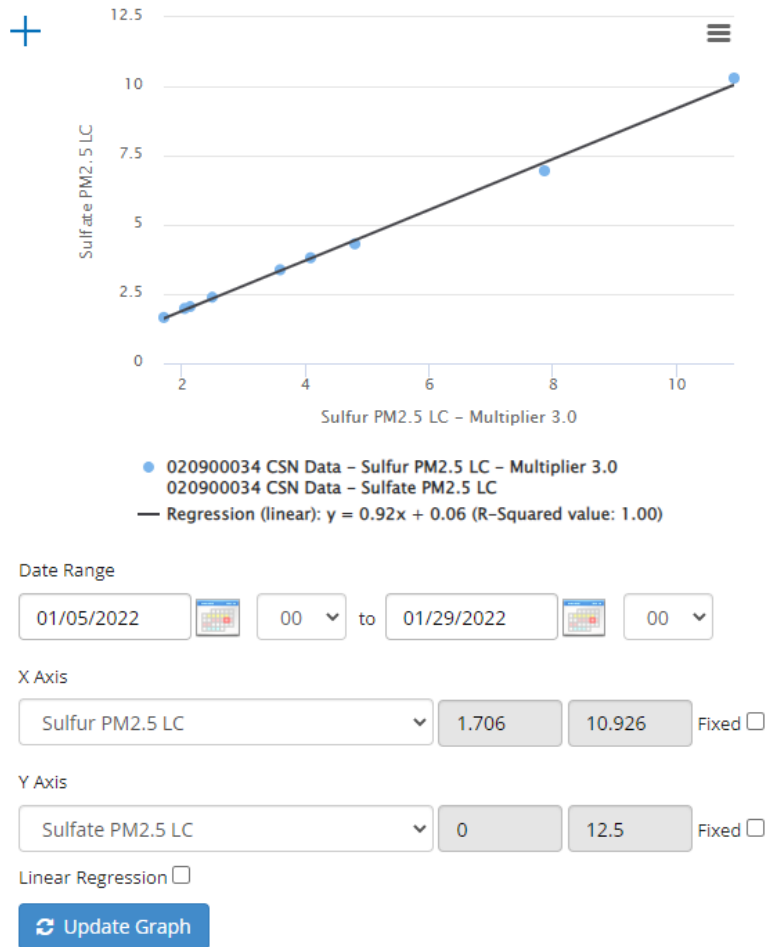


Figure 18. A comparison of the Sulfur PM2.5 & Sulfate PM2.5 concentrations using the DART scatter plot tool. No data points should significantly deviate from the linear regression model generated when plotting Sulfate vs. the scaled Sulfur values.

The AMQA reviewer **should not**:

- Invalidate samples with the “**Filter Integrity - FX**” or “**Matrix Effect - MX**” qualifier codes unless additional information supports invalidation.
- Remove “**Transport Temp - TT**” or “**Method Detection - MD**” flags.
- Use the “**Request Exclusion - Rx**” flags.
- For further details on each of these items please see page 13 of the *CSN Data Validation Guide*.

There are several common issues that the reviewer should **pay close attention to**, including:

- Incorrectly transcribed *ambient temperature, barometric pressure, flow CV*, and *sample volume* parameter values.
 - These issues can be corrected by editing the parameter values in the **Batch Data** menu (Figure 16).
- Outlying data points.



- Outliers warrant further investigation and should be flagged with the “**5 – Outlier**” qualifier code unless there is additional evidence that the data is valid.
- Sample time out of limits.
 - The SASS & URG instrument are programmed to run for 24 hours. If the sample time is not equal to 24 hours but is within 24 hours \pm 1 hour, the “**Elapsed Sample Time out of Spec - Y**” qualifier code should be applied. If the sample time is less than 23 hours or greater than 25 hours, the “**Sample Time out of Limits – AG**” null code should be applied.
- Flow rate out of limits.
 - If the instrument flow rate was outside the valid range for flow values, or the flow CV is greater than 2% for URG-3000N or 5% for the SASS, the “**Sample Flow Rate out of Limits - AH**” null code should be applied. If the flow rate was within 10% of the nominal flow rate specified for the instrument, but additional evidence suggests that the flow rate may be higher or lower than the expected value, the “**Flow Rate Average out of Spec - W**” qualifier code should be applied.

Based on their findings, the data analyst will make changes and additions as necessary and approve the data. After the 30-day period, CSN data are automatically returned to the lab, any comments and qualifier and null code changes are reviewed and validated by UCD staff, and they are subsequently imported into AQS. Designated AMQA staff will load QC and audit checks to AQS (Figure 19).

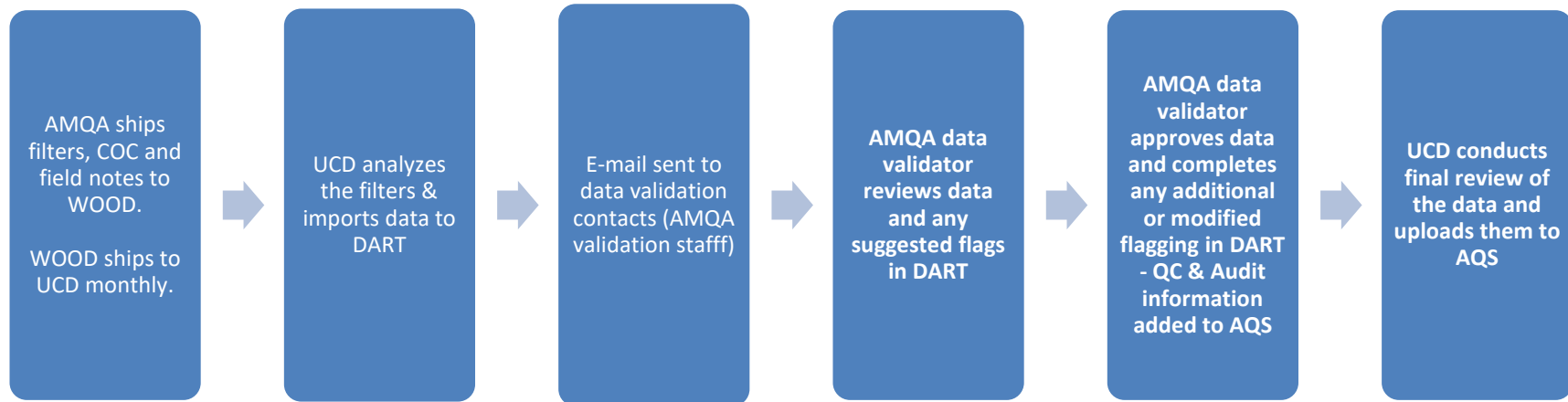


Figure 19: CSN data flow schematic.



4.7 Corrective Action Process

If a systematic, data collection, instrumentation, or other error is discovered during or after the data collection or data validation process, the QA officer should be notified and included in a discussion to determine what corrective action is required in accordance with the ADEC *Quality Assurance Project Plan (QAAP)*. Depending on the issue, the Field Operations Manager, AQS submitter, and Level 1 and/or Site Operators should also be notified and included in the discussion. If the issue affects data that has already been submitted to AQS, the AQS submitter will take appropriate action to revise and resubmit the affected data. Once a **Corrective Action** is determined, a **Work Item** will be created using the **Work Item Editor** in AirVision to track the Corrective Action Process. This will allow responsibility and a deadline to be assigned for the completion of the tasks necessary.



5. DATA REPORTS AND WEB PRESENCE

Near real-time data is posted on DEC's website as an Air Quality Index (AQI) and as daily charts that plot the hourly averaged data for the day. As time and staffing allows, DEC develops annual, multiyear site reports, or trend reports for all monitoring sites which are posted to the program's website. As public outreach, the AMQA program started posting annual graphs of PM_{2.5} concentrations for communities close to or violating the NAAQS.

The report shall present:

- Description, location and the monitoring objectives for the site.
- Comparison of ambient air concentrations determined by the monitor program to NAAQS and the calculated design value for the site.
- Applicable trend analysis related to meteorological or climatological conditions and/or source attribution.

DEC uses the collected data to report air quality conditions in the form of an AQI for all the monitoring sites on its own public website

(<http://dec.alaska.gov/Applications/Air/airtoolsweb/Aq/>). DEC makes preliminary data available on the website for the most recent months and provides a process by which citizens can request data directly from DEC via email. Data requests are given final, verified AQS quality data and must be approved by the AMQA Program Manager. Legislative data requests must be approved by the AMQA Program Manager and Air Quality Division Director. The DEC legislative liaison will send the data to the relevant legislator.

6. DATA ARCHIVE

Ambient air quality monitoring data used to demonstrate compliance with NAAQS regulations are legally considered as credible evidence. All data and related records used in the development of the final validated data set submitted to the EPA AQS database shall be maintained in a data archive system in perpetuity.

These records shall include:

- Copies of all station logbook, maintenance logs, operational or status checklists.
- Results of all QC checks and any QA performance audits performed during the reporting period.
- Comparisons of the Data Acquisition System (DAS) primary data source to a secondary data source which is typically a direct download data from the analyzer.
- All spreadsheets used for data and QC calculations.
- Raw data file as recorded by the primary DAS.
- Edited data files annotated with AQS data null and qualifier codes with an explanation of missing, suspect, and invalidated data.



- Monitoring data chronology developed during the data review and editing process.

The **Envista** database houses all of the semi-continuous monitor data (both raw and finalized) as well as the electronic logbook, automatic and manual ZPS checks, and meteorological data for data collected prior to January 2021. The associated auxiliary data that do not fit into the Envista database are housed in AMQA's **Data Warehouse** a web-based component of the Division's **AirTools** database. Finally, the LIMS MTL system that is used in the Fairbanks and Juneau (and Chester Labs) gravimetric labs contains records of the gravimetric lab conditions, certifications and data for all gravimetric analyzers.



7. REFERENCES

DART CSN *Data Validation Quick Reference Guide* version 1.1, UC Davis, nd.

DEC *Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program*. <http://dec.alaska.gov/air/air-monitoring/quality-assurance-plans> 105 pp April 2017).

DeWinter, J., S. Brown, H. Hafner, & B. Landis *DART for CSN (Data Analysis and Reporting Tool for Chemical Speciation Network Data)*. EPA & Sonoma Technology, Inc. National Ambient Air Monitoring Conference, PAMS Session, St. Louis, August 10, 2016.

EPA *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G8. <https://www.epa.gov/quality/guidance-data-quality-assessment>, November 2002.

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EPA *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II Ambient Air Quality Monitoring Program* <https://www3.epa.gov/ttn/amtic/qalist.html> January 2017.

EPA 2019 CSN TSA Sampler Audit and Flow Check Worksheet.xls, 2019

FNSB *Quality Assurance Project Plan for the PM_{2.5} Speciation Trends Network* http://dec.alaska.gov/air/am/am_airqual-guidQA.htm, August 2009.



8. DEFINITIONS OF ACRONYMS

ADVP	Automatic Data Validation Processor, is a patented processor designed by Agilaire which allows an unlimited number of logical rules to be applied to data, resulting in data that is flagged, graded, annotated, coded, and/or emailed to designated users
AMQA	Air Monitoring & Quality Assurance program within the Alaska Department of Environmental Conservation, Air Quality Division
AQI	Air Quality Index, a normalization of criteria pollutants so that the parameters can be compared directly to one another
AQS	Air Quality Subsystem, EPA database storing ambient air quality data
CFR	Code of Federal Regulation, which is used to reference federal regulations; for example, 40 CFR 58 is the reference for Title 40, Code of Federal Regulations, Part 58
COC	Chain of Custody
CSN	Chemical Speciation Network
CV	Coefficient of Variance
DART	Data Analysis and Reporting Tool
DAS	Data Acquisition System, which for the purposes of this manual, represents a computer-based system that records and stores electronic signals from the ozone analyzer, and provides programmed functions to perform automated quality control checks
DEC/ADEC	Alaska Department of Environmental Conservation
Envista	the central database, also called the Envista database (DB)
EPA	United States Environmental Protection Agency
FEM	Federal Equivalent Monitors
FRM	Federal Reference Method
LIMS	Laboratory Information Management System
MD	Method Detection (data review qualifier code)
MDL	Method Detection Limit



MTL	Measurement Technologies Laboratory Filter Weighing System
NAAQS	National Ambient Air Quality Standards, which are air quality standards established in regulation under 40 CFR 50 to protect human health and the environment
NCORE	an EPA program to establish a national multi pollutant monitoring network that integrates several advanced measurement systems for particles, pollutant gases and meteorology; also used to refer to Alaska's only NCORE site
PM	Particulate Matter
QA	Quality Assurance
QA Officer	AMQA's quality assurance officer who makes the final validity determination for data collected by AMQA staff when in question and reports directly to the Air Quality Director in their capacity of independent auditor
QAPP	Quality Assurance Project Plan
QC	Quality Control
SASS	Speciation Air Sampling System
SLAMS	State and Local Air Monitoring Station
SNL	Site Node Logger (Model 8872 data logger)
SOP	Standard Operating Procedure
SPM	Special Purpose Monitoring
UCD	University of California, Davis



9. APPENDIX A: ADVP RULES



ADVP Rule Name	Description	Action
AmbT_Spike	Amb temp delta > 3 at 5 min interval. The value increases or decrease more than 2 degrees between readings.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM Qt OOR	BAM local flow rate is out of range. Less than 0.655 lpm or greater than 0.753 lpm	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM RH > 35	BAM relative humidity greater than 35%	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM Tamb OOR	BAM ambient temperature is out of range. Less than -60 degC or greater than 30 degC.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM PM10L OOR	BAM PM10L is out of range. Less than -10 ug/m3 or greater than 400 ug/m3.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM PM2.5L OOR	BAM PM2.5L is out of range. Less than -10 ug/m3 or greater than 400 ug/m3.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
BAM 985	BAM has error code concentration of 985	Apply '< - Logger Invalid' flag. Email notification
T640x Bypass Flow OOR	T640x bypass flow (T640_QtBypass) out of range. Less than 11.12 or greater than 12.29.	Apply '? – Suspect' flag Add annotation with ADVP category
T640x Sample Flow OOR	T640x sample flow (T640_Qt) out of range. Less than 4.75 or greater than 5.25.	Apply '? – Suspect' flag Add annotation with ADVP category
WD S OOR	Wind direction scalar out of range. Less than 0 degrees or greater than 360 degrees.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
WS S OOR WS V OOR	Wind speed scalar/vector out of range. Less than 0 mps.	Apply '? – Suspect' flag Add annotation with ADVP category Email notification
Garden CO ZPS	Garden's CO ZPS check on Monday and Friday at 03:00.	Apply 'BF – Precision/Zero/Span' AQS Null Code to hourly value Add annotation with ADVP category
Garden CO AutoZero	Garden's CO Auto Zero at 00:00 nightly	Apply 'AY – Quality Control (QC) Control Points (Zero/Span)' to hourly value Add annotation with ADVP category



10. APPENDIX B: DATA IMPORT REQUEST

**Information needed for data import request:**

- Site for data import
- Parameters
- Date and time range
- Is the instrument time ending or beginning? *Please note that Agilaire is time beginning.*
- Overwrite, update or fill blanks?

- **Overwrite** means *all* data from the import file will *overwrite* the data already in Agilaire. This means flags/comments will be erased since all values are being replaced.

Update means the data from the import file will only change the values in Agilaire if the Agilaire data is different from what's in the import file. This means any flags/comments already in place will stay in place.

Fill Blanks means only data blanks in Agilaire will be updated. All other values and their flags/comments will remain. See below for examples. Yellow highlights show which values are updated during the import.

- Overwrite:

Import File	Agilaire	Final Agilaire Values
1/1/22 00:05 100	1/1/22 00:05 100	1/1/22 00:05 100 (overwritten, no flags/comments remain)
1/1/22 00:10 75	1/1/22 00:10 95	1/1/22 00:10 75
1/1/22 00:15 15	1/1/22 00:15	1/1/22 00:15 15
1/1/22 00:20 30	1/1/22 00:20 10	1/1/22 00:20 30

- Update:

Import File	Agilaire	Final Agilaire Values
1/1/22 00:05 100	1/1/22 00:05 100	1/1/22 00:05 100 (not overwritten, any flags/comments remained)
1/1/22 00:10 75	1/1/22 00:10 95	1/1/22 00:10 75
1/1/22 00:15 15	1/1/22 00:15	1/1/22 00:15 15
1/1/22 00:20 30	1/1/22 00:20 10	1/1/22 00:20 30



○ Blanks:

Import File	Agilaire	Final Agilaire Values
1/1/22 00:05 100	1/1/22 00:05 100	1/1/22 00:05 100 (not updated, any flags/comments remained)
1/1/22 00:10 75	1/1/22 00:10 95	1/1/22 00:10 95 (not updated, any flags/comments remained)
1/1/22 00:15 15	1/1/22 00:15	1/1/22 00:15 15
1/1/22 00:20 30	1/1/22 00:20 10	1/1/22 00:20 30 (not updated, any flags/comments remained)

Tips:

- Only provide relevant data.
- Dates/data don't have to be continuous. Agilaire matches the time interval, so the data import file doesn't have to be continuous.
- *Be aware that Agilaire Admins won't be able to complete a data import request immediately, so please submit the request with plenty of time ahead of your personal deadline.*



11. Appendix C: Review Checklists



The following Data Review Checklist templates are appended in the document as Microsoft Excel worksheets:

- Agilaire BAM Data Review Checklist Rev 1.2
- Agilaire CO Data Review Checklist Rev 1.1
- Agilaire NO.NOy.Diff Data Review Checklist Rev 1.1
- Agilaire O3 Data Review Checklist Rev 1.1
- Agilaire Partisol Data Review Checklist Rev 3.1
- Agilaire SO2 Data Review Checklist Rev 1.1 t
- Agilaire T640x Data Review Checklist
- Filter Lab Data Review Checklist



12. APPENDIX D: NAMING CONVENTION GUIDANCE DOCUMENT



Standardized Naming Convention

- <Site Name>_<Criteria Pollutant>_<Instrument>_<Purpose>_<Date Relevant (MMDDYY)>
 - eg: Butte_PM2.5_E112_Calibration_102820.pdf
 - eg: NCORE_PM10_BAM_QCcheck_012322.pdf
- <Site Name>_<Criteria Pollutant>_<Instrument>_<Purpose>_<Date Start>_to_<Date End>
 - eg: Parkgate_PM10_BAM_ZeroAirTest_102520_to_102820.xls

Partisol Instrument Identifier Naming Convention

The Partisol identifiers consist of a letter followed by three numbers. The identifier is determined as follows:

First letter: Designates town/region

- A= Fairbanks
- B= North Pole
- C= Juneau
- D= Anchorage
- E= Mat-Su

First Number: Designates specific site in town/region

- A1= Fairbanks State Office Building
- A2= Fairbanks NCORE
- A3= A Street

Second Number: Designates PM2.5 or PM10 sampling

- 1= PM2.5
- 2= PM10

Third Number: Designates primary or secondary monitor for collocation purposes

- 1= Primary
- 2= Secondary

- Eg: E112
- E: Mat-Su
- 1: Butte site



- 1: PM2.5
- 2: Secondary

Therefore, from the identifier it can be determined that E112 is the secondary collocated PM2.5 sampler located at the Butte site in the Mat-Su Region

- Eg: C122

- C: Juneau
 - 1: Floyd Dryden Site
 - 2: PM10
 - 2: Secondary

Based on the identifier C122, it can be determined the monitor is a collocated PM10 sampler located at the Floyd Dryden site in Juneau.



13. APPENDIX E: DATA FILES SUBMITTED TO AQS



Table E-1. Complete list of raw data files by site/analytes that are currently submitted to AQS by DEC. In Q1-Q3 58 different raw data files are submitted to AQS (plus 63 meta-data files for the PM2.5 Partisol instruments) and in Q4 59 raw data files are submitted (plus the 63 met-data files for the PM2.5 Partisol instruments).

Site	Parameter	Instrument
NCore	CO	Teledyne T300U
NCore	O3	Thermo 49iQ
NCore	SO2	Thermo 43iQ
NCore	SO2 5-min	Thermo 43iQ
NCore	NO	Teledyne T200U
NCore	NOy	Teledyne T200U
NCore	NOy-NO	Teledyne T200U
NCore	PM 10L	MetOne BAM
NCore	PM 10S	MetOne BAM
NCore	PM 2.5L	MetOne BAM
NCore	PM 2.5 Calc**	MetOne BAM
NCore	PM 2.5L*	Partisol 2025i - A211
NCore	PM 2.5L*	Partisol 2000i (2) - A212
NCore	PM 10L	Partisol 2000i - A221
NCore	PM 10S	Partisol 2000i - A221
NCore	PM Course	Partisol 2000i (A221-A212)
NCore	AT 3m	MetOne T-200
NCore	AT 10m	MetOne T-200
NCore	WD (V) 3m	RMYoung sonic anem.86004
NCore	WD (V) 10m	RMYoung sonic anem.86004
NCore	WS (V) 3m	RMYoung sonic anem.86004
NCore	WS (V) 10m	RMYoung sonic anem.86004
Hurst Rd	PM 2.5L*	Partisol 2025i B111
Hurst Rd	PM 2.5L*	Partisol 2025i B112
Hurst Rd	PM 2.5L	MetOne BAM
Hurst Rd	SO2	Thermo 43i
Hurst	SO2 5-min	Thermo 43i
Hurst Rd	WD (V) 3m	MetOne sonic anem.
Hurst Rd	WD (V) 10m	MetOne sonic anem.
Hurst Rd	WD (V) 23m	MetOne sonic anem.
Hurst Rd	WS (V) 3m	MetOne sonic anem.
Hurst Rd	WS (V) 10m	MetOne sonic anem.
Hurst Rd	WS (V) 23m	MetOne sonic anem.
A Street	PM 2.5L	MetOne BAM
A Street	PM 2.5L*	Partisol 2025i
A Street	WD (V) 3m	MetOne sonic anem.



A Street	WD (V) 10m	MetOne sonic anem.
A Street	WS (V) 3m	MetOne sonic anem.
A Street	WS (V) 10m	MetOne sonic anem.
Floyd D	PM10L	Teledyne T640X
Floyd D	PM10S	Teledyne T640X
Floyd D	PM 2.5L	Teledyne T640X
Floyd D	PM 10L	Partisol 2000i
Floyd D	PM 10S	Partisol 2000i
Floyd D	PM 2.5L*	Partisol 2000i
Butte	PM 10L	MetOne BAM
Butte	PM 10S	MetOne BAM
Butte	PM 2.5L	MetOne BAM
Garden	CO	TECO 48i
Garden	PM2.5L*	Partisol 2000i
Garden	PM10S	Partisol 2000i
Garden	PM10L	Partisol 2000i
Garden	PM 10S	MetOne BAM
Garden	PM 10L	MetOne BAM
Garden	PM 2.5L	MetOne BAM
Laurel	PM 10L	MetOne BAM
Laurel	PM 10S	MetOne BAM
Parkgate	PM 10L	MetOne BAM
Parkgate	PM 10S	MetOne BAM

*PM 2.5L Partisol data submission includes 9 additional metafiles: Sample Flow Rate CV, Sample Volume, Ambient Min Temp, Avg Ambient Temp, Ambient Max Temp, Min Ambient Press, Avg Ambient Press, Max Ambient Press, Elapsed Sample Time

** Submitted for full year in Q4

Table E-2. Complete list of QA/QC data files submitted to AQS on a quarterly basis

1-Point QC			
Site	Parameter	Instrument	Data Source
NCore	CO	Teledyne T300U	ZPS Check
NCore	O3	Thermo 49iQ	ZPS Check
NCore	SO2	Thermo 43iQ	ZPS Check
NCore	NO	Teledyne T200U	ZPS Check
NCore	NOy	Teledyne T200U	ZPS Check
Hurst	SO2	Thermo 43i	ZPS Check
Garden	CO	TECO 48i	ZPS Check
Flow Rate Verification			



NCore	PM 10L	MetOne BAM	Monthly QC
NCore	PM 10S	MetOne BAM	Monthly QC
NCore	PM 2.5L	MetOne BAM	Monthly QC
NCore	PM 2.5L	Partisol 2025i - A211	Monthly QC
NCore	PM 2.5L	Partisol 2000i (2) - A212	Monthly QC
NCore	PM 10L	Partisol 2000i - A221	Monthly QC
NCore	PM 10S	Partisol 2000i - A221	Monthly QC
Hurst Rd	PM 2.5L	Partisol 2025i B111	Monthly QC
Hurst Rd	PM 2.5L	Partisol 2025i B112	Monthly QC
Hurst Rd	PM 2.5L	MetOne BAM	Monthly QC
A Street	PM 2.5L	MetOne BAM	Monthly QC
A Street	PM 2.5L	Partisol 2025i	Monthly QC
Floyd D	PM10L	Teledyne T640X	Monthly QC
Floyd D	PM10S	Teledyne T640X	Monthly QC
Floyd D	PM 2.5L	Teledyne T640X	Monthly QC
Floyd D	PM 2.5L	Partisol 2000i	Monthly QC
Floyd D	PM 10L	Partisol 2000i	Monthly QC
Floyd D	PM10S	Partisol 2000i	Monthly QC
Butte	PM 10L	MetOne BAM	Monthly QC
Butte	PM 10S	MetOne BAM	Monthly QC
Butte	PM 2.5L	MetOne BAM	Monthly QC
Garden	PM 10L	MetOne BAM	Monthly QC
Garden	PM 10S	MetOne BAM	Monthly QC
Garden	PM 2.5L	MetOne BAM	Monthly QC
Garden	PM2.5L	Partisol 2000i	Monthly QC
Garden	PM10L	Partisol 2000i	Monthly QC
Garden	PM10S	Partisol 2000i	Monthly QC
Laurel	PM 10L	MetOne BAM	Monthly QC
Laurel	PM 10S	MetOne BAM	Monthly QC
Parkgate	PM 10L	MetOne BAM	Monthly QC
Parkgate	PM 10S	MetOne BAM	Monthly QC

Semi-Annual Flow Rate Audits

Submitted as needed

Annual PE

Submitted as needed



14. APPENDIX F: CSN WORKSHEET





