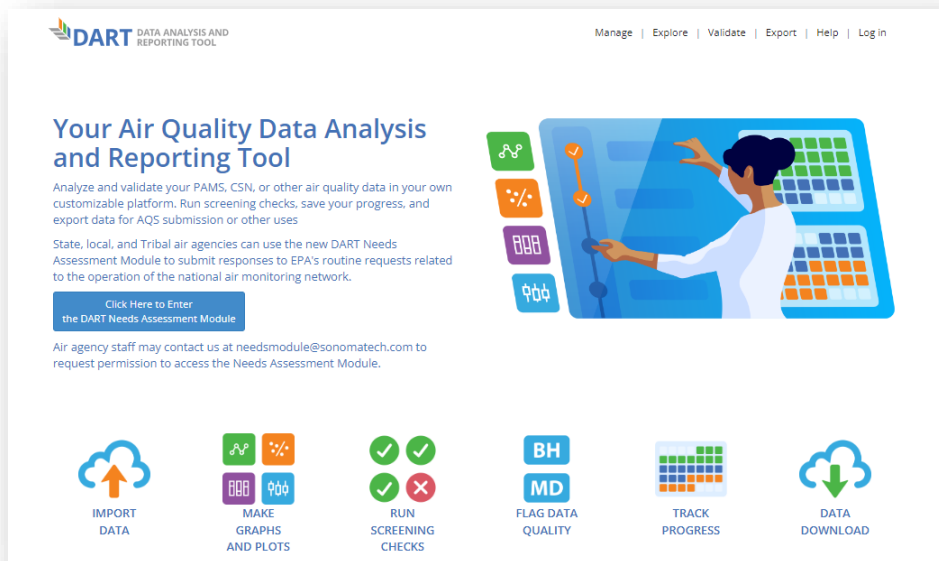


# Data Analysis and Reporting Tool (DART) User's Guide for Validation of Data from the Chemical Speciation Network

Version 1



Prepared for

U.S. Environmental Protection Agency (EPA)

July 2024

This document contains blank pages to accommodate two-sided printing.

# Data Analysis and Reporting Tool (DART) User's Guide for Validation of Data from the Chemical Speciation Network

Version 1

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User's Guide

STI-920401

July 5, 2024



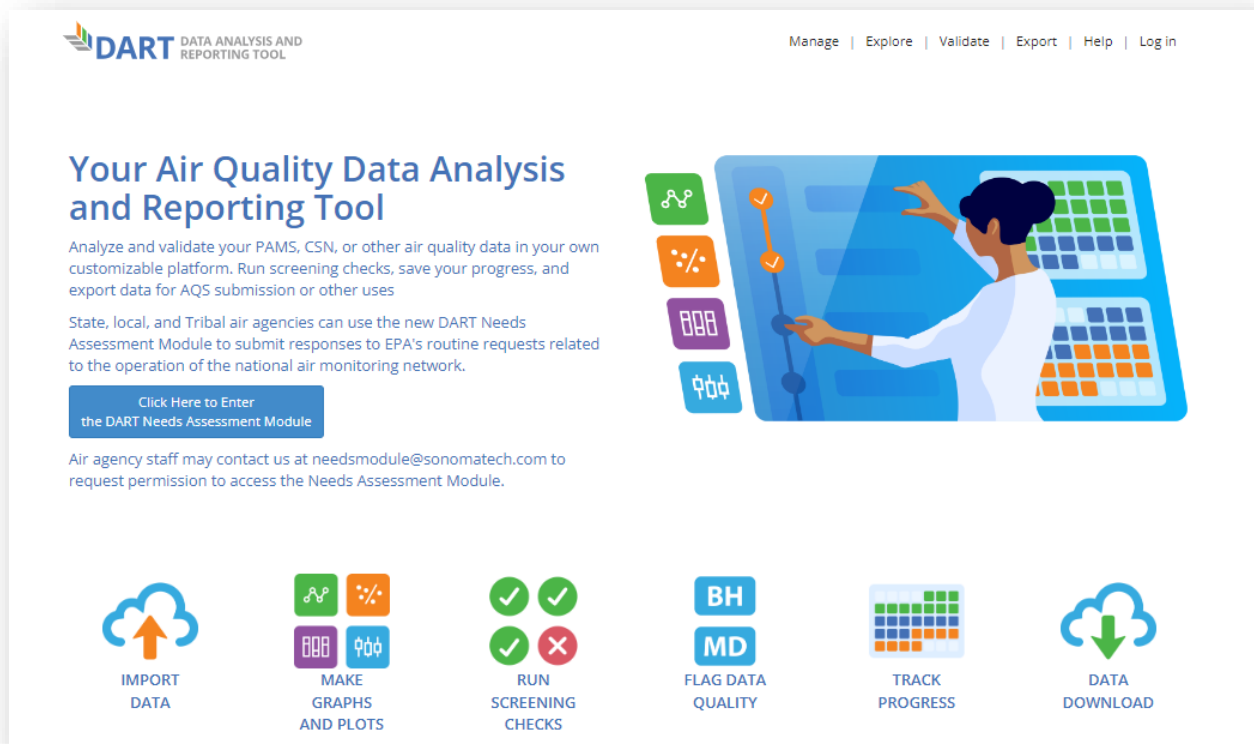
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# 1. Introduction

Welcome to DART (Data Analysis and Reporting Tool), a web-based data validation and analysis tool that supports monitoring agencies to manage, explore, validate, and prepare air quality and meteorological data for Air Quality System (AQS) submission. DART was designed for data validation of Photochemical Assessment Monitoring Stations (PAMS) data, and routine validation of PM<sub>2.5</sub> speciation data for the Chemical Speciation Network (CSN). DART provides tools for validating and analyzing PAMS data, including volatile organic compound (VOC) measurements, as well as other air quality measurements (e.g., ozone, lead, air toxics, speciated particulate matter (PM), and meteorological measurements). DART features include automated screening, statistical summaries, and exports of AQS-formatted data files.



## 1.1 Background

DART was first developed by Sonoma Technology to support the validation and analysis of VOCs and other related data collected as part of the PAMS program. Subsequently, DART was developed to support validation and analysis of chemical speciation data collected as part of the CSN program. In

2014, a work order (WO) with Sonoma Technology resulted in a beta version and in 2015, a public version of DART was made available as a tool under the AirNowTech.org website. Follow-on WOs in 2016-2020 continued the development of DART; analytical tools and import/export functions specifically for the CSN were added during this time. In 2020, DART was transitioned out of AirNowTech.org and is now a stand-alone application.

## 1.2 What Can You Do With DART

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DART provides tools for:

- Preparing data for submission to AQS
- Reviewing laboratory results for speciation data
- Uploading data files
- Making data requests to the U.S. EPA's Air Quality System (AQS)
- Performing unit conversions
- Aggregating data
- Creating time series graphs and editing data
- Creating scatter plots
- Creating bar charts and fingerprint plots
- Performing screening checks
- Exporting data and summary statistics

## 1.3 Contact Information

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Contact the entire CSN support team described in Section 2 of this User's Guide, including U.S. EPA and Sonoma Technology, at [CSNSupport@sonomatech.com](mailto:CSNSupport@sonomatech.com) for any CSN related questions, DART support, and recommendations for changes to DART.

DART related comments, questions, and suggestions can also be provided to Sonoma Technology through the DART website ([dart.sonomatech.com](http://dart.sonomatech.com)) or to the email address [dart@sonomatech.com](mailto:dart@sonomatech.com).



## 1.4 What is in this User's Guide

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This User's Guide provides an overview of the primary areas of DART (Manage and Approval Mode) that are relevant for using DART as part of routine validation of PM<sub>2.5</sub> speciation data for CSN. The "More Information" section of this User's Guide provides additional resources about CSN data validation.

DART also supports data validation of PAMS data. Please refer to the [DART for PAMS User's Guide](#) for information about the use of DART for PAMS data validation.

We've used the following typographic conventions in this document:

- **Bold text** indicates a command or the name of a software element, such as a window, tab, or field.
- File names and variables are in *italics*.
- Folder names are surrounded by slashes; for example, \FolderName\.

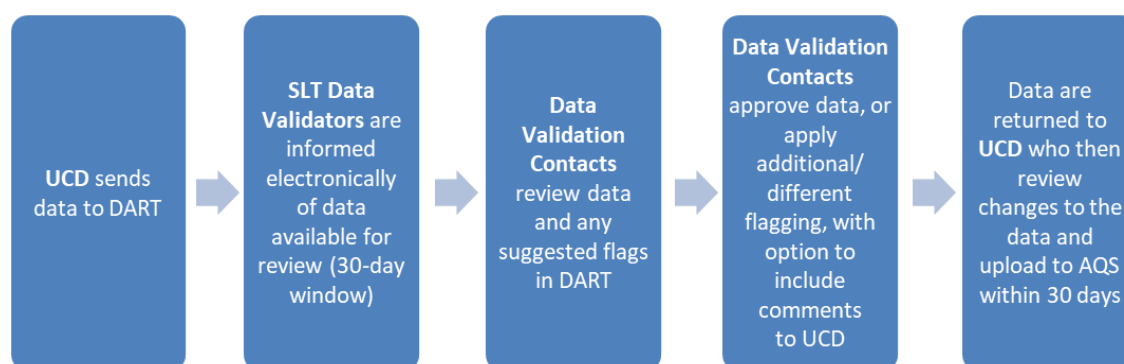
## 2. DART for CSN

CSN was established in 2000 as a component of the national PM<sub>2.5</sub> monitoring network that serves to assess attainment status of the National Ambient Air Quality Standard (NAAQS) for PM<sub>2.5</sub>.<sup>1</sup> CSN is an ambient air monitoring network consisting of sites measuring speciated PM<sub>2.5</sub> that are located in heavily populated areas to support activities such as PM<sub>2.5</sub> trends analysis, development of State Implementation Plans (SIPs), and health effects analysis. CSN data are not used for attainment determinations.

The CSN data validation process, including use of DART for CSN, is a collaboration between the major organizations involved in the CSN Program:

- U.S. EPA Office of Air Quality Planning and Standards (EPA OAQPS),
- Air Quality Research Center at University of California at Davis (UCD) (analytical laboratory and AQS data submission),
- RTI International (analytical laboratory and filter shipping and handling laboratory), and
- Sonoma Technology (DART development and operations), as well as
- State, local, and tribal (SLT) agencies operating CSN monitoring sites or validating data.

Each month, DART is used routinely by the CSN program for review and validation of CSN samples. Figure 2 shows the CSN data validation process in DART.



<sup>1</sup> <https://www.epa.gov/amtic/chemical-speciation-network-csn>

CSN data batches from the analytical laboratory are sent to DART for review and validation by approved CSN data validators in each SLT agency. SLT validators review data in DART and as owners of the data, their review is important to ensure that the final data in AQS are correct. Sample batches typically arrive in DART for the 30-day SLT agency validation period approximately 120 days after the end of the sampling month. SLT validators are automatically notified via email when new CSN data are available in DART for review. At the end of the review period, the data are automatically returned to the analytical laboratory for submission to AQS.

The following Sections of this User's Guide provide information for CSN data validators using DART for routine validation of CSN data batches. Specific webpages in DART are used as part of the CSN program including DART's **Manage** webpage and DART's **Approval Mode** webpage. The User's Guide also provides information about how to setup DART users to be CSN data validators. Additional tutorials covering use of DART for CSN data validation are suggested in the "More Information" Section.

### 3. The Importance of Data Validation

*Why should I validate my data?*

Data review and validation consists of procedures developed to: ensure that data collected are suitable for their intended use; to identify deviations from data and measurement objectives and procedures; to minimize the generation of additional data that may be invalid or suspect; and to maximize the recoverable data.

Data review and validation often includes identifying data issues and outliers so that they can be corrected or invalidated prior to AQS submission and subsequent uses for analysis or modeling. Without careful screening of data, the wrong conclusions may be drawn when invalid, incomplete, or inadequate data are used. Outliers are data that are spatially, temporally, or physically inconsistent with typical observations at a particular site.

*There are four general levels of data review:*

The EPA recommends a tiered data review approach and has defined four common levels of data review and associated activities<sup>2</sup>. DART was developed to support Level 1 and Level 2 review.

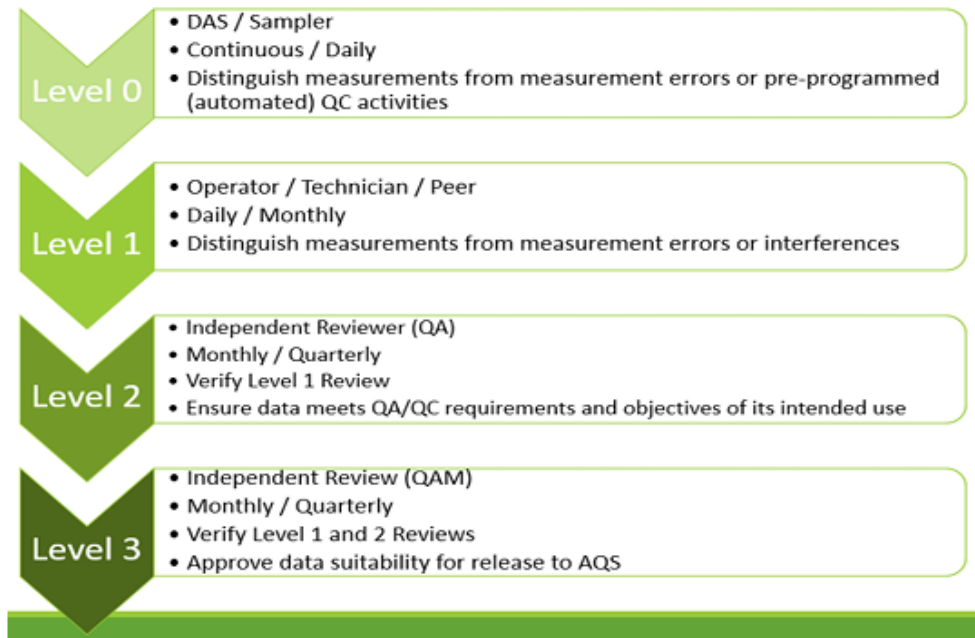


Figure 17: Summary of Levels 0 – 3 Data Review Activities

<sup>2</sup> <https://www.epa.gov/system/files/documents/2021-10/data-validation-guidance-document-final-august-2021.pdf>

*General procedures for data validation include:*

1. Assemble the Level 0 or Level I database.
2. Place data in a common data format with descriptive information regarding variables, validation level, quality control (QC) codes, time standard, and standard units.
3. Ensure that results of and suggestions from final audit reports have been incorporated into the database.
4. Review simple statistics for unrealistic maxima or minima and for consistency with nearby stations (data are still Level I).
5. Perform spatial and temporal comparisons of the data (begin Level II).
6. Perform intercomparisons of the data (e.g., from two different collocated instruments). Data are now Level III.

*Helpful tips for performing data validation:*

- Proceed from the big picture to the details.
- Inspect every species, even to confirm the expectation that a species would normally be absent.
- Know the monitoring site characteristics, topography, prevalent meteorology, and major emissions sources nearby.

For more information about CSN data validation and analysis procedures and examples, refer to the CSN Data Validation Guide<sup>3</sup>.

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<sup>3</sup> <https://airquality.ucdavis.edu/csn-documentation>

## 4. Getting Started as a CSN Validator

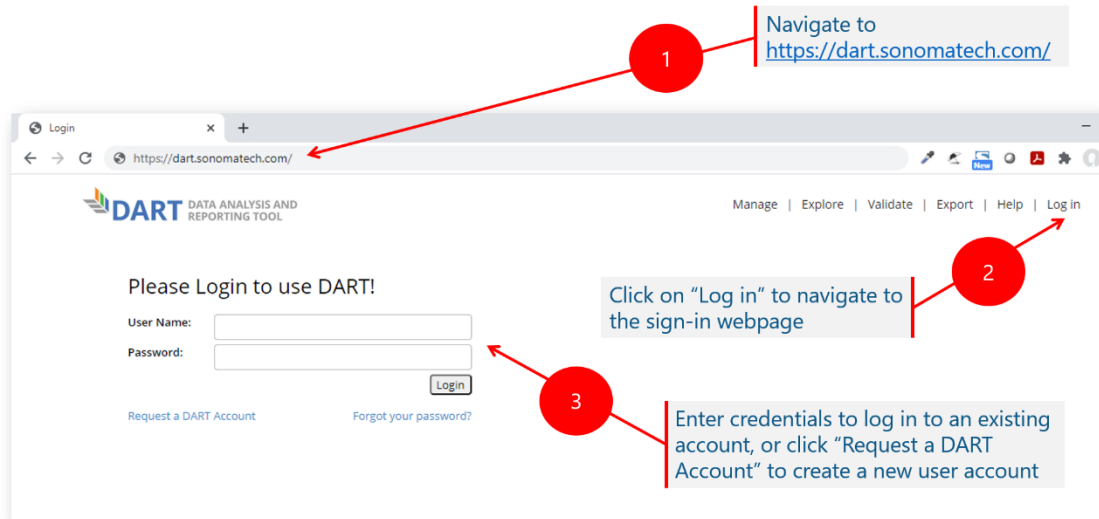
There are two steps for you to be setup as a CSN validator in DART.

1. Request a DART account.
2. Ask your DART administrator at your Agency to configure your new DART account as a CSN validator and/or to receive CSN related emails; you can also email [csnsupport@sonomatech.com](mailto:csnsupport@sonomatech.com) and request that your account be setup.

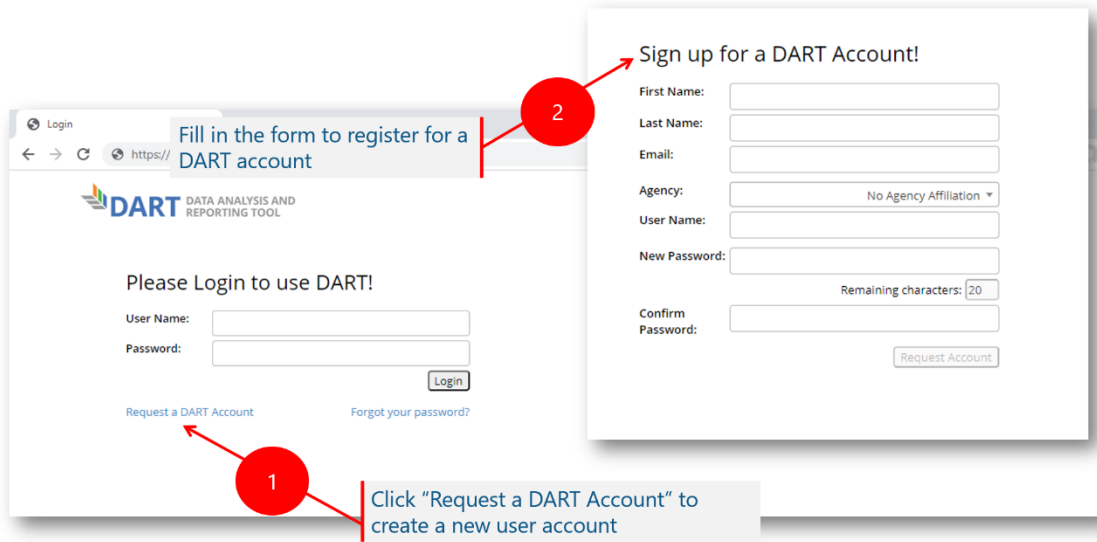
### 4.1 Accessing DART and Setting up your Account

To get started with DART, first use an Internet browser to navigate to the DART website at <https://dart.sonomatech.com>. Google Chrome is the preferred Internet browser; we also support Firefox.

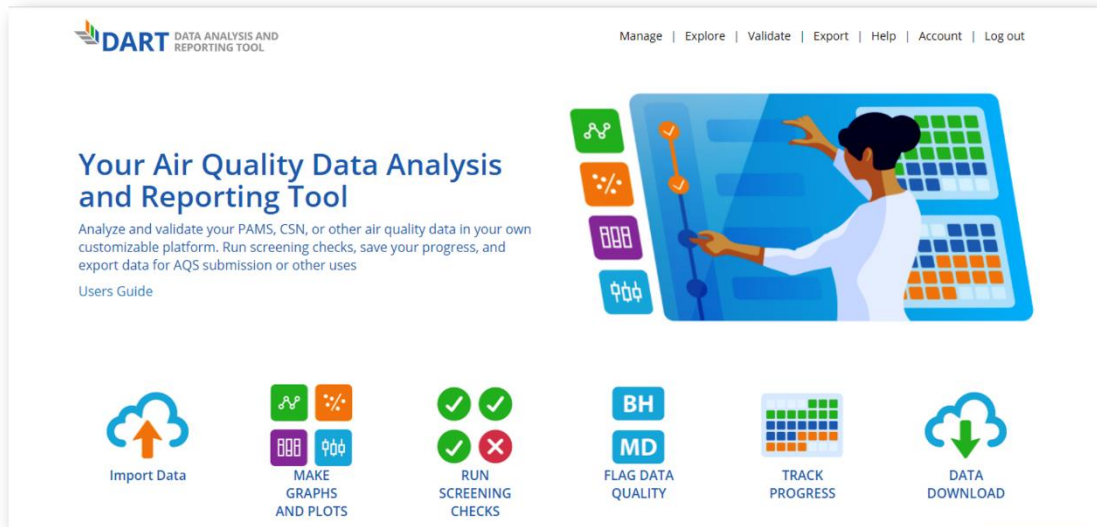
Next, log in with an existing DART account. (Choose **Log in** in the upper right corner of the main page.)



If you don't already have a DART account, you can choose the **Request a DART account** link or navigate to <https://dart.sonomatech.com/requestAccount/>. After filling in the form to register for a new account, you will receive an email prompting you to click the link provided in the email to activate your new DART account. It is important to request an account for the agency that is responsible for the CSN monitoring site(s) that you will be validating in DART.



After you login, you will see the DART Welcome page, which explains the basic steps to using DART. You can return to this page at any time by clicking the **DART** link at the top left of the screen.



## 4.2 Configuring CSN Data Validators in DART

Configure DART user accounts to be CSN data validators using the **Manage Users** webpage. This webpage is accessible from the DART **Manage** page by clicking the **Manage Users** link at the top right of the **Agency** dataset table. Only DART users that are setup as administrators for their agency are able to access the **Manage** webpage.

The screenshot shows the DART web interface. At the top left is the DART logo (DATA ANALYSIS AND REPORTING TOOL). At the top right are navigation links: Manage | Explore | Validate | Export | Help | Log out. The main content area is titled 'Your Air Quality Agency Data Sets'. A 'Manage Users' link with a user icon is highlighted with a red box. Below this is a table with columns: Date Received, Type, Data Set Name, Date Range (LST), Data Status, Download, and Approval Status. The table contains four rows of data, all with 'Ready for use' status. Below the table is a 'Show 10 entries' dropdown and 'Previous 1 Next' navigation. Below this is a section titled 'My Data Sets' with an 'add data +' link. It contains a table with columns: Date Received, Type, Data Set Name, Date Range (LST), Data Status, Download, and Delete. It contains one row of data with 'Ready for use' status. Below this table is another 'Show 10 entries' dropdown and 'Previous 1 Next' navigation.

The **Manage Users** webpage shows a table of all DART users with accounts registered for the selected Agency. For each DART user shown in the table, there are three configurable settings that can be enabled (checked) or disabled (unchecked) for CSN:

**CSN Admin:** Configure the Agency administrator(s) who can access the Manage Users webpage and configure the CSN Validators for their Agency

**CSN Validator:** Configure the DART users that can access Approval Mode to review CSN data

**CSN Emails:** Configure the DART users that will receive automated emails from DART related to CSN data batches



Sonoma Technology

Search:  Export

Agency	Name	User Email	CSN Admin	CSN Validator	CSN Emails
Sonoma Technology	Bryan Penfold	bryan@sonomatech.com	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sonoma Technology	Jennifer DeWinter	jdewinter@sonomatech.com	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sonoma Technology	Anthony Cavallaro (Dev)	acavallaro@sonomatech.com	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sonoma Technology	Marcus Hylton	mhylton@sonomatech.com	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sonoma Technology	User Rights	xwl52321@nbzmr.com	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sonoma Technology	Data Editor	zyz44795@nbzmr.com	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sonoma Technology	test test	test@test.com	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Users who do not appear in the table do not have an AirNow-Tech account or their AirNow-Tech account is assigned to a different agency. Please have such users request an **AirNow-Tech Account** for the correct agency.

If a user should no longer be affiliated with an agency, please contact CSN Support (csnsupport@sonomatech.com) via email.

Agency Admins should regularly update their Agency Admin(s) and CSN Validators. Below are the steps for the Agency Admin to configure new CSN Validators:

1. Register the new validator for a DART account for the desired Agency (if not already done)
2. Login to DART and navigate to the Manage Users webpage
3. Find the appropriate row in the table for the new validator and check the boxes in the 'CSN Validator' and 'CSN Emails' columns

To disable a DART user from being a CSN Validator and/or Agency Admin, uncheck the same boxes to prevent the user from accessing CSN data in DART and/or receiving automated DART CSN emails.

## 5. DART Manage Webpage

Use the DART **Manage** webpage to view your data sets, download data files, and access **Approval Mode**. Depending on your DART account, there may be one or two tables on the **Manage** screen:

- **My Datasets** table lists the data that are private and only accessible in your DART account
- **Agency** table lists the CSN data that are accessible to all DART users who have a DART account configured as CSN validators for your agency

As part of the CSN data validation process, DART routinely receives data directly from the air quality analytical laboratory. Currently, PM<sub>2.5</sub> speciation data are transferred to DART from the Air Quality Research Center at the University of California, Davis. Data from the laboratory are provided to DART via secure File Transfer Protocol (sftp) and are automatically made available in the correct DART user accounts for each CSN monitoring site.

CSN data are listed in the **Agency** table on the **Manage** screen. CSN data will only be available in your DART user account if you are configured as a CSN validator for the appropriate agency. Each row in the **Agency** table displays information about CSN data batches for one CSN site. Information includes the date when the samples were received from the laboratory and uploaded to DART, and the date range of all CSN data in DART for that site. The **Agency** table also provides options for **downloading** CSN data in AQS or CSV file format<sup>4</sup>.

Finally, the **Agency** table provides an icon to indicate the **Approval Status**: a yellow exclamation point icon indicates there are samples that still require review; a green check mark icon indicates samples have all been reviewed; a lock icon indicates that the data batch is no longer available for review.

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<sup>4</sup> DART maintains a large historical data set for each CSN site to facilitate the routine data review and validation process prior to AQS submission of new data. DART is regularly updated to obtain the latest data from AQS however all data in DART should still be considered preliminary. It is recommended that CSN data be obtained directly from AQS for data analysis or other purposes outside of routine CSN data review.

Click the **Approval Status** icon to navigate to DART's **Approval Mode** webpage for CSN data review.

The screenshot displays the DART Manage Webpage interface. At the top left is the DART logo (DATA ANALYSIS AND REPORTING TOOL). The main header reads "Your Air Quality Agency Data Sets" with a "Manage Users" link. A table lists four CSN data sets, each with a "Ready for use" status and a yellow warning icon in the "Approval Status" column. Three red circles with numbers 1, 2, and 3 are overlaid on the interface: circle 1 points to the first row, circle 2 points to the download icon, and circle 3 points to the warning icon. A text box on the left states "Date samples were received from the laboratory". A text box at the bottom center says "Download data in AQS or CSV format". On the right, a sidebar titled "Approval Status" shows three options: "Batch Needs Approval" (warning icon), "Approved Batch" (checkmark icon), and "Locked Batch" (lock icon).

Date Received	Type	Data Set Name	Date Range (LST)	Data Status	Download	Approval Status
05/24/2018	Lab - CSN	CSN Data	01/04/2013 - 12/30/2017	Ready for use		
06/11/2018	Lab - CSN	CSN Data	01/04/2013 - 12/30/2017	Ready for use		
07/12/2018	Lab - CSN	CSN Data	01/01/2013 - 12/30/2017	Ready for use		
07/12/2018	Lab - CSN	CSN Data	01/04/2013 - 12/27/2017	Ready for use		

Show 10 entries Previous 1 Next

**Approval Status**

- Batch Needs Approval
- Approved Batch
- Locked Batch

## 6. DART Approval Mode for CSN Validation

DART receives CSN data from the laboratory in batches that are available for review and validation using the DART **Approval Mode** webpage. After a CSN data batch is received from the laboratory, CSN data validators are notified of new data via email and then have 30 days to review the laboratory results in **Approval Mode**.

DART's **Approval Mode** includes the following tools to aid in data review:

- Description of the number of samples, date range, and "Review by" deadline for the data batch
- Sample summary table for each sample in the batch, describing the number of species, number of qualifier and/or null codes applied to the data, data completeness, and percent of data above the method detection limit (MDL)
- Batch data table displaying the parameter concentration value, MDL, data uncertainty, and null or qualifier codes, for all the data in the batch
- Editing options for changing null and qualifier codes, certain data values, and leaving comments
- Time series, stacked bar, scatter plot, and fingerprint plot for visually reviewing the data
- Map of concentrations across the national network for evaluating spatial patterns

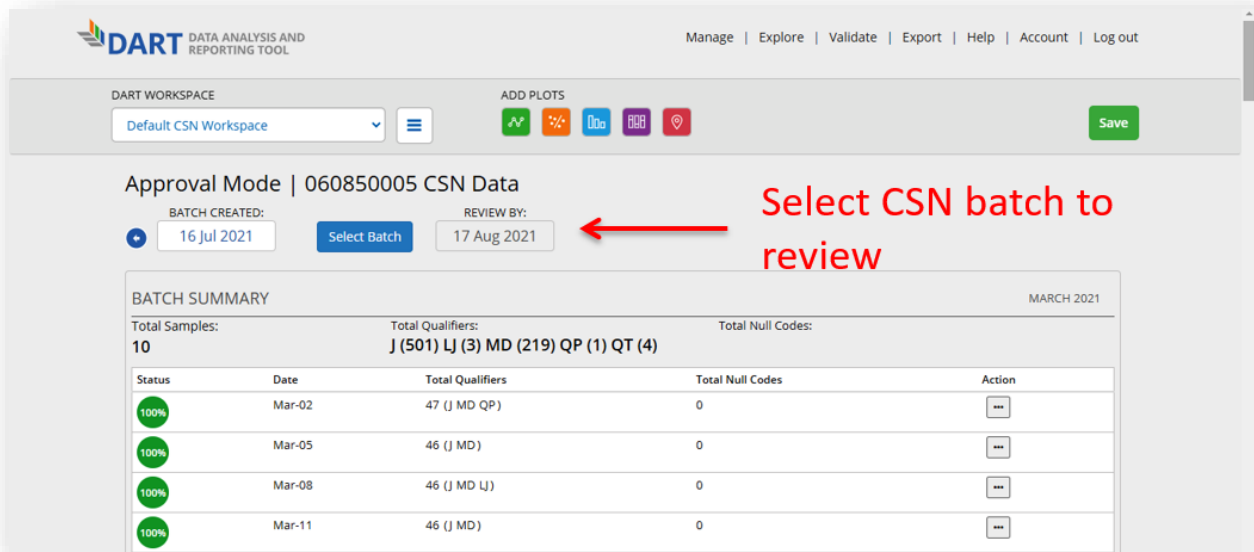
After the 30-day review period, the data batch is locked and no additional changes can be made in DART. CSN data are then automatically sent back to the laboratory. The laboratory reviews any null or qualifier code changes and the comments provided by the data validators; the laboratory then prepares the final data for submission to AQS.

### 6.1 Selecting a Batch

---

The CSN site, date the data batch was received in DART, and the Review By date are displayed at the top of the **Approval Mode** webpage for a data batch.

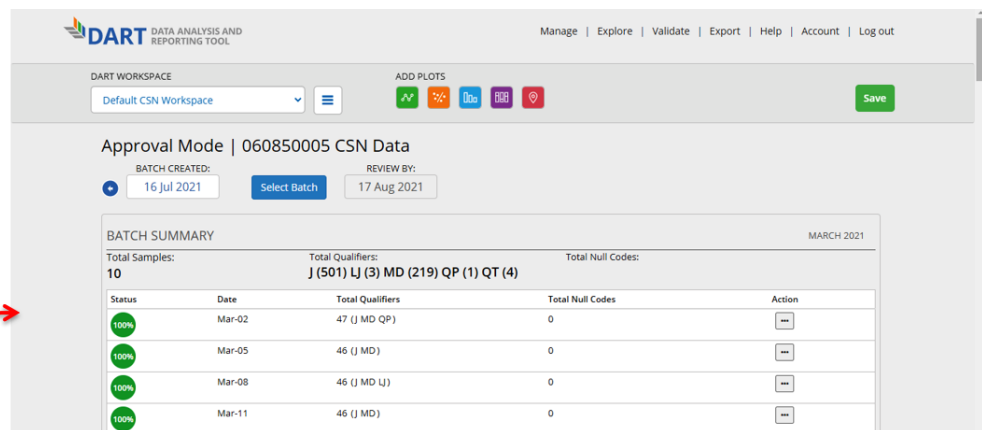
Entering **Approval Mode** from the **Manage** webpage displays the most recent data batch in DART. Occasionally, there may be more than one data batch available for review, or you may wish to access a locked data batch. Use the blue arrows or click **Select Batch** to view data from other data batches.



## 6.2 Batch Summary and Editing Sample Date

View a summary of the data batch including the number of samples in the batch and statistics for each sample date.

View data completeness and hover over the icon to view additional information



Use the action button to edit sample date(s)

Click the **action button** to leave a comment indicating that a sample date is incorrect as currently recorded and provide the correct date. Please **do not** use the **Edit Date** window to leave comments

that are not related to the sample date; other comments can be applied using the **Edit Batch** window.

Editing steps using the window:

← View sample date & enter the correct sample date

← Select parameters to apply date change comment to

← Select a commonly used comment or enter a custom comment

← Preview/edit comment to be applied

← Save the comment

## 6.3 Batch Data Table

View the data for the batch in the **Batch Data Table** including the concentration value for each parameter for ambient samples and blanks, values for auxiliary parameters, method detection limit (MDL), and uncertainty values. Filter the table on any text including parameter AQS code using the search box. Sort the table by clicking the column name.

### 6.3.1 Edit Batch Window

Edit null and/or qualifier codes using the **Edit Batch** window. To access the **Edit Batch** window, click on the icon in the null code or qualifier code column in the row of the Batch Data table for the species that you would like to edit.

DART WORKSPACE

Default CSN Workspace

ADD PLOTS

Retain Parameters Across Batches

Save

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input checked="" type="checkbox"/>	Dec-03	Aluminum PM2.5 LC	6	-0.0198	2	0.03218	0.02019	ug/m3	<input checked="" type="checkbox"/>	MD	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Aluminum PM2.5 LC	7	-0.00975	7	0.03215	0.0197	ug/m3	<input checked="" type="checkbox"/>	MD	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Ion PM2.5 LC	6	1.58629	99	0.00835	0.11274	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Ion PM2.5 LC	7	1.74778	100	0.00835	0.1242	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Nitrate PM2.5 LC	6	3.74778	99	0.0539	0.28671	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Nitrate PM2.5 LC	7	3.55887	99	0.05391	0.27245	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Sulfate PM2.5 LC	6	3.9635	84	0.01532	0.24591	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Ammonium Sulfate PM2.5 LC	7	4.52537	93	0.0153	0.28073	ug/m3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
<input type="checkbox"/>	Dec-03	Antimony PM2.5 LC	6	-0.01856	4	0.03878	0.02403	ug/m3	<input checked="" type="checkbox"/>	MD	<input checked="" type="checkbox"/>

Select All Mark Reviewed Undo Restore

Below is the step-by-step process to use the Edit Batch window.

**Edit Batch**

Recent Comment:  
Comment has not been added yet.

Sample Date(s):  
Jun 2, 2023

Apply to:  
Apply to species in selected sample from the PTFE filter (Elements by XRF and Light Absorption by HIPS)

Warning: You are editing the null code or qualifier code(s) for multiple species.

POC: 5

Ambient  Field Blanks  Both

Include operational parameters

XRF  HIPS

Overwrite Codes

Edit Null Code:  
No null code

Edit Qualifier Code:  
\* MD - Value less than MDL

Warning: You are editing the null code or qualifier code(s) for multiple species...  
Warning: You are editing composite or contributing parameter(s)...

Preview:

Original	New
Jun 2, 2023	Jun 2, 2023
Aluminum PM2.5 LC (5) : [], [MD]	Aluminum PM2.5 LC (5) : [], [MD]
Antimony PM2.5 LC (5) : [], [MD]	Antimony PM2.5 LC (5) : [], [MD]
Arsenic PM2.5 LC (5) : [], [MD]	Arsenic PM2.5 LC (5) : [], [MD]
Barium PM2.5 LC (5) : [], [MD]	Barium PM2.5 LC (5) : [], [MD]
Bromine PM2.5 LC (5) : [], [MD]	Bromine PM2.5 LC (5) : [], [MD]
Cadmium PM2.5 LC (5) : [], [MD]	Cadmium PM2.5 LC (5) : [], [MD]

Edit Comment:

**Editing steps using the window:**

- ← View latest comment
- ← Select date(s) to edit
- ← Select Parameter(s) to edit
- ← Select null or qualifier code(s)
- ← Preview code changes
- ← Enter comment

### Step 1: View Latest Comment

If available, review the most recent comment related to the selected species; nothing will display here if no comments have been left. Comments may be left by the laboratory or other data validators within your agency if they have applied null or qualifier code(s) or have a question or comment for the laboratory. If null or qualifier code(s) for the selected species have been changed in DART, the comment may display details about the change, including the previous null/qualifier code(s) and what they were changed to.

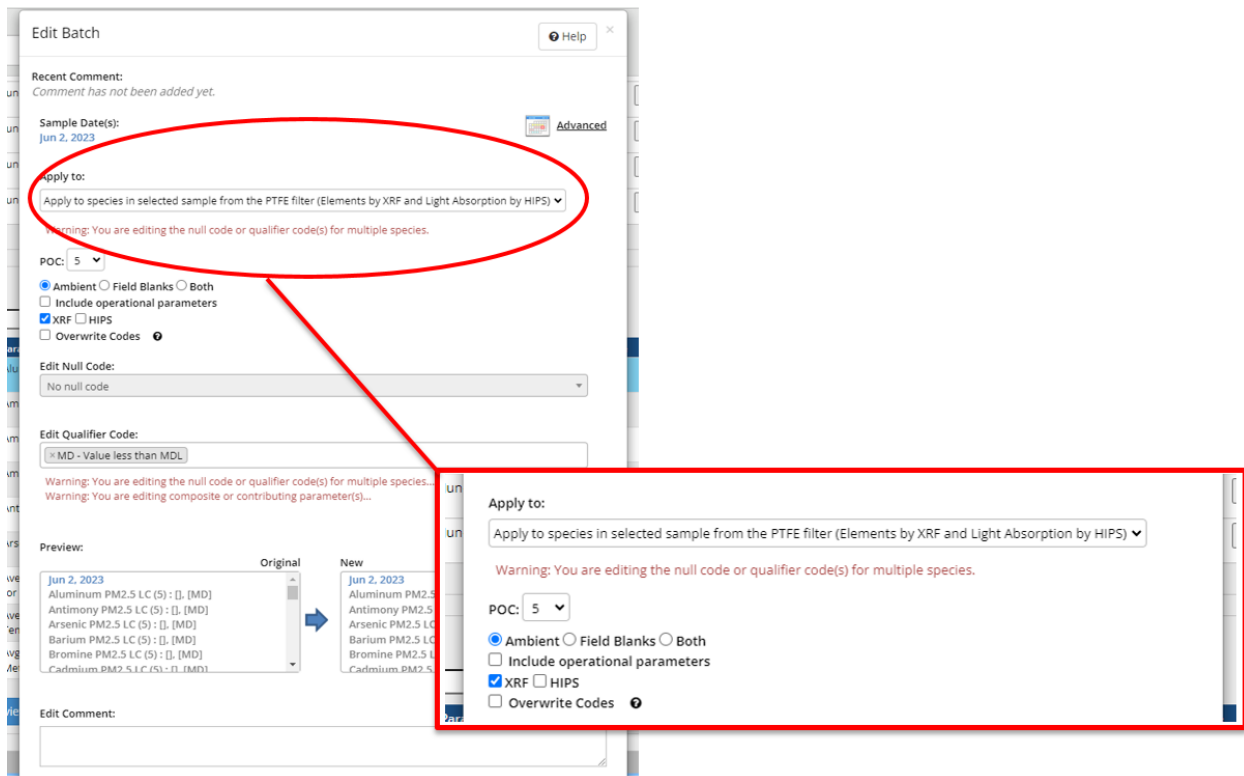
Please note: to view all comments for a parameter and sample date, click the **Log** icon in the **Comments** column of the **Batch Data Table**.

### Step 2: Select Sample Date(s)

By default, edits are made to the selected species for the date of the selected row. Click the **calendar icon** to select a different sample date; more than one date can be selected and edited simultaneously.

### Step 2: Select Parameters to Edit

In the drop-down menu, choose the species or group of species that you would like to edit.





The drop-down menu of parameters include the following options. A table of parameters for each filter type, and the operational parameters, is included in Appendix A.

Group Name in DART	Edits Apply to:
"Apply to Selected Species"	Single parameter for single date (date of row that is selected in the table), unless multiple dates are specified
"Apply to Entire Sample Event (includes all filter types)"	all analytical parameters for all three filters for single date, unless multiple dates are specified
"Apply to species in selected sample from the PTFE filter (Elements by XRF and Light Absorption by HIPS)"	all analytical parameters for the PTFE for single date, unless multiple dates are specified; only Elements measured by XRF are included by default (option to also/only select Fabs measured by HIPS)
"Apply to Ion species in selected sample (measured by IC from the Nylon filter)"	all analytical parameters for the Nylon filter for single date, unless multiple dates are specified
"Apply to Carbon species in selected sample (measured by TOA from the Quartz filter)"	all analytical parameters for the Quartz filter for single date, unless multiple dates are specified
"Apply to Operational parameters in selected sample"	all operational parameters for single date, unless multiple dates are specified

Additionally, choose to

- **Edit a specific Parameter Occurrence Code (POC)** – select a POC from the drop-down menu; DART defaults to the POC for the selected row
- **Include ambient, blanks, or both** – check the box(es) to edit ambient samples only, blank samples, or both ambient and blank samples for the selected date(s)
- **Include/exclude operational parameters** – if this box is checked, the edits will also apply to all operational parameters for the selected filter. Operational parameters include
- **Include XRF/HIPS or both** – check the box(es) to include parameters measured by X-Ray Fluorescence (XRF), Hybrid Integrating Plate and Sphere (HIPS) or both; this option is only available if "Apply to species in selected sample from the PTFE filter (Elements by XRF and Light Absorption by HIPS)" is selected in the drop-down menu

- **Overwrite codes** – if this box is checked, DART will first remove all existing null or qualifier codes for the selected parameters and dates, and then apply the codes specified in the **Edit Batch** window

Null and/or qualifier codes, and comments, are editable for a subset of the PTFE species based on analysis type

- Edit only the elements from the XRF analysis
- Edit only the light absorption coefficient (Fabs) from the HIPS analysis
- Edit both the elements and the light absorption coefficient

Only the elements from the XRF analysis are edited by default if this group of parameters is selected

The operational parameters for each filter type are as follows:

- PTFE: temperature, pressure, flow rate, volume transport temperature
- Nylon: flow rate, volume transport temperature
- Quartz: Temperature, pressure, flow rate, volume transport temperature

### *Step 3: Choose Null Code or Qualifier Code(s)*

Choose the null code or qualifier code(s) that you would like to add or remove from the selected species by using the drop-down menus. A species measured in a sample can have either a null code or qualifier code(s), but not both. Therefore, if the selected species already has a qualifier code(s) and you would like to apply a null code, you must first remove the existing qualifier code(s) by clicking the "x" next to the code in the qualifier drop-down menu. Similarly, if the selected species already has a null code and you would like to apply a qualifier code or codes, you must first remove the existing null code by selecting "No null code" from the null code drop-down. Please note that if a species concentration is missing, which displays as the value -999 in DART, a null code is required.

By default, only the specific null and qualifier code(s) will be appended or removed based on the user's selections in the Edit Batch window. All other existing null and qualifier code(s) currently applied to the species or a group of species will be retained. DART also has an option to overwrite all existing null and qualifier code(s) prior to applying the new null or qualifier code(s) specified by the user in the Edit Batch window. Check the "Overwrite Codes" box next to the "Apply to" drop-down menu to first remove all existing codes.

### Step 4: Add a Comment Describing Changes

Add a comment to describe the changes you are making to the null code and/or qualifier code(s). Comments provide helpful information that is shared with other data validators in your agency. All comments and associated null or qualifier code changes are also provided to the laboratory at the end of the data review period.

### Step 5: Preview and Save

Use the **Preview** windows to review the data before and after the changes. Once complete, click "Save" to apply your changes or click "Cancel" to exit the window.

## 6.3.2 Edit Batch Reminders

- A data record can have either a null code or qualifier code(s), but not both:
  - To apply a null code to a selected parameter that already has a qualifier code(s), first remove the qualifier code(s) by clicking the "x" next to the code in the qualifier drop-down menu.
  - To apply a qualifier code(s) to a selected parameter that already has a null code, first remove the existing null code by selecting "No null code" from the null code drop-down.
- If a parameter value is missing, which displays as the value -999 in DART, a null code is required.
- If a null data code has been applied (e.g. AM – misc void) but you have additional information available, please update to a more specific null code (e.g. AV – power failure)
- If composite variables Reconstructed Mass and/or Soil are invalid, please use the AI - Insufficient Data (cannot calculate) null code.

## 6.3.3 Edit Values

Sometimes the values for operational parameters are recorded incorrectly in the field sheet. To correct in DART, click the button in the **Value** column to edit the value for the pressure, temperature, flow rate, and volume parameters.

Batch Data

Filter:

Reviewed	Date	Parameter	POC	Value	Ptile	MDL	Unc.	Unit	Null Code	Qual. Code	Comments
<input type="checkbox"/>	Dec-03	Arsenic PM2.5 LC	5	-1.1E-4	4	0.00186	0.00113	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Average Ambient Pressure for URG3000N	5	.999	41	0.0		mmHg	<input type="checkbox"/>	AJ	<input type="checkbox"/>
<input checked="" type="checkbox"/>	Dec-03	Average Ambient Temperature for URG3000N	5	.999	29	0.0		°C	<input type="checkbox"/>	AJ	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Avg Ambient Pressure for MetOne SASS/SuperSASS	5	749.0	11	0.0		mmHg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Avg Ambient Temperature for MetOne SASS/SuperSASS	5	16.2	33	0.0		°C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Barium PM2.5 LC	5	-0.01484	8	0.08	0.0487	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Bromine PM2.5 LC	5	0.00819	100	0.00454	0.00302	ug/m3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Cadmium PM2.5 LC	5	-0.00145	16	0.01577	0.0096	ug/m3	<input type="checkbox"/>	MD	<input type="checkbox"/>
<input type="checkbox"/>	Dec-03	Calcium PM2.5 LC	5	0.0431	81	0.02498	0.01683	ug/m3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Select All

### 6.3.4 Undo, Restore, and Mark Reviewed

The **Batch Data Table** includes options to undo edits and to mark data reviewed.

- **Undo** – Click **Undo** to undo the last edits made.
- **Restore** – Click **Restore** to clear all edits and restore the data to the version DART received from the laboratory
- **Mark Reviewed** – Check the box(es) in the **Reviewed** column for the rows that you have validated. Click **Mark Reviewed** to flag the selected rows as Reviewed. The analytical laboratory assumes data that were not marked as reviewed are approved by the agency.

## 6.4 Using the Time Series and Other Plots

**Approval Mode** includes a suite of plots to facilitate data review including time-series, stacked bar, scatter plot, and fingerprint plot. A national map of concentrations across all CSN sites is also available. Default plots are included in the **Default CSN Workspace**; add, remove, and customize your own plots. All plots are interactive; zoom in by dragging a box with your cursor.

Each plot provides a similar set of options to customize the display including:

- **Parameter selector** – Click the **Plus button** to select the parameters to plot; specific parameters are displayed in the **Default CSN Workspace**

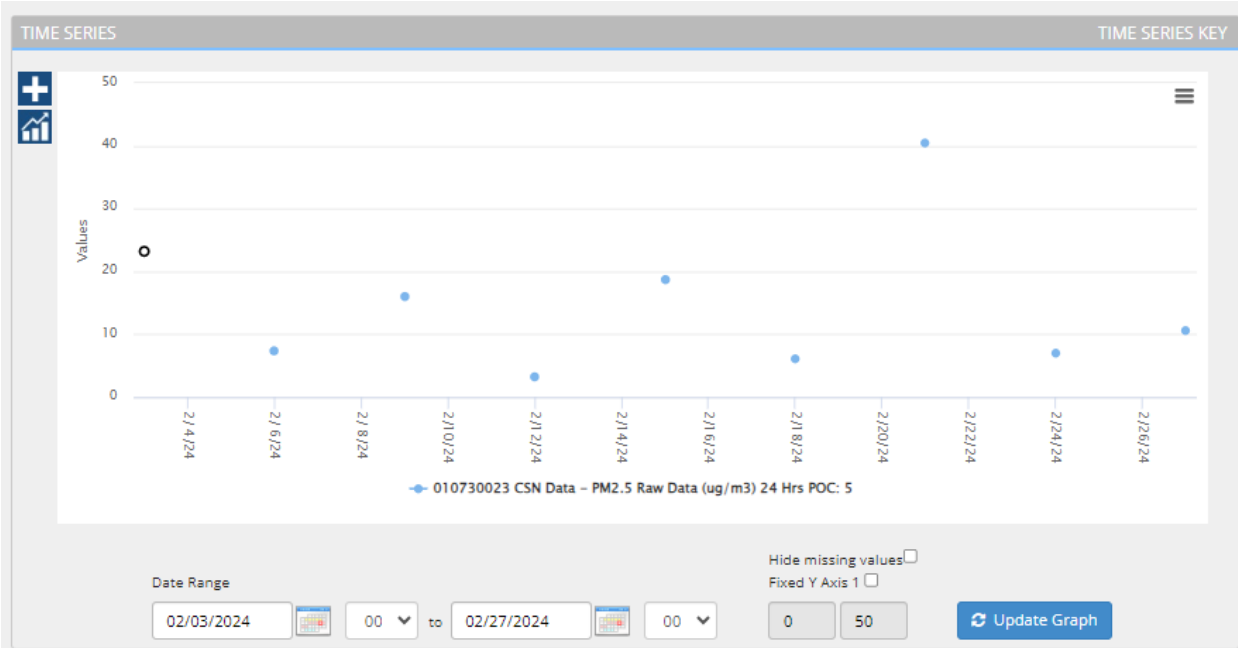
- **Date Range** – Click the calendar icons to change the start date and end date range of data on the plot; plots display the time period of the data batch in the **Default CSN Workspace**
- **Axis min/max** – Check the **Fixed Y Axis** box and enter a value in the input box for the y-axis minimum and maximum settings
- **Hover display** – Hover over a data point on the plot to view information such as the date, parameter, concentration value, null code or qualifier code(s) applied
- **Key** – Each plot includes a legend that is accessible by clicking the link in the upper right corner of the plot header

### 6.4.1 Time-series

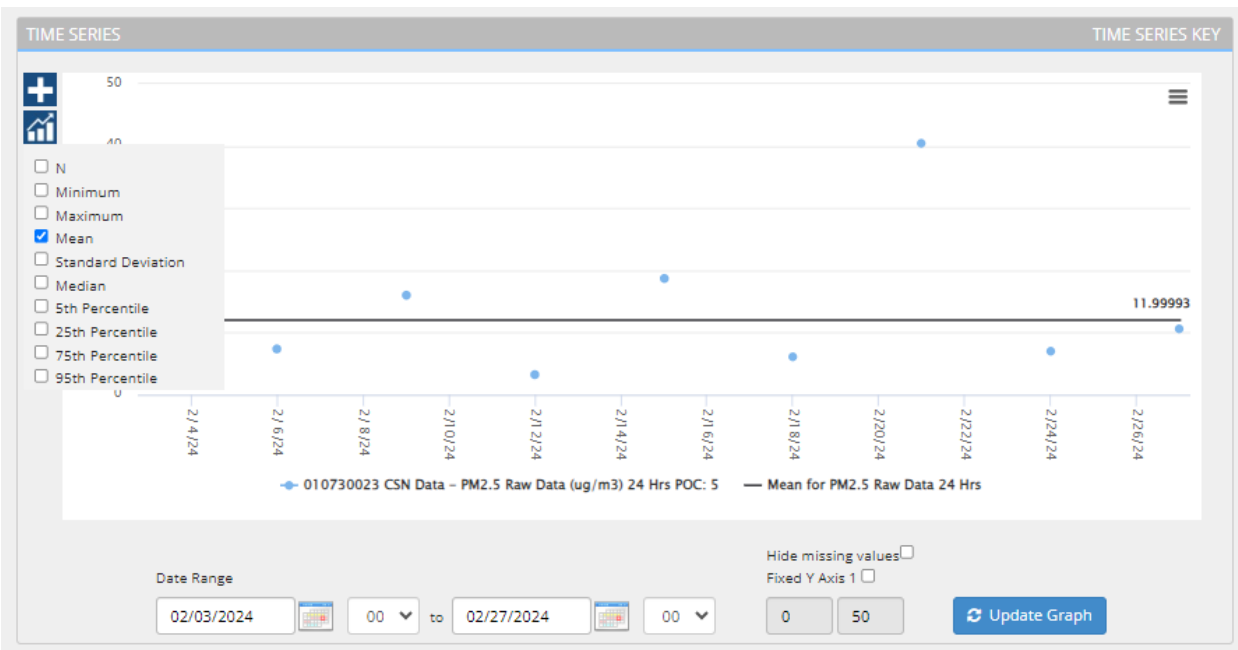
Time-series plots allow you to understand temporal characteristics and patterns in your data and screen for potential outliers. Inspect time-series plots for the following:

- Large “jumps” or “dips” in the concentrations
- Periodicity of peaks
- Expected behavior during different days of the week and season
- Expected relationships among species

The time-series plot defaults to display the concentrations of PM<sub>2.5</sub> mass for the data batch. Click a row in the **Batch Data Table** to update the time series plot to display the parameter for the selected row.



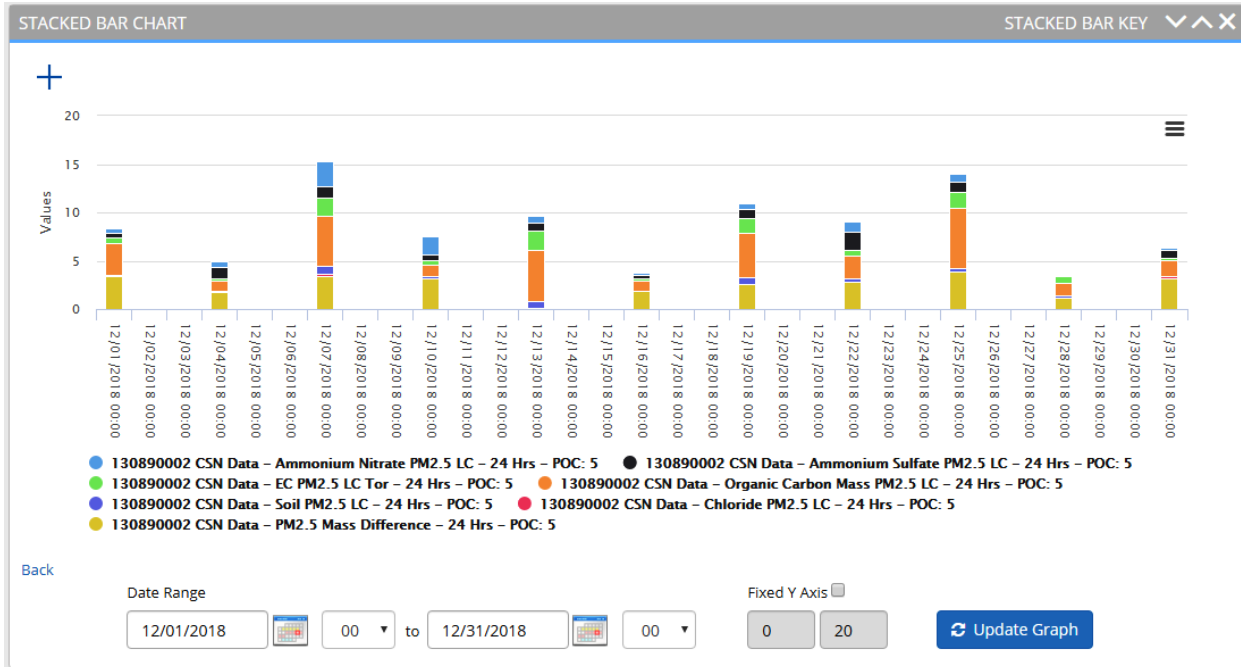
The time series includes a **Statistics** icon. Click the **Statistics** icon to display statistics on the plot including the count, minimum, maximum, mean, standard deviation, median, 5<sup>th</sup>, 25<sup>th</sup>, 75<sup>th</sup>, and 95<sup>th</sup> percentiles. Statistics are calculated using the entire data record.



## 6.4.2 Stacked bar plot

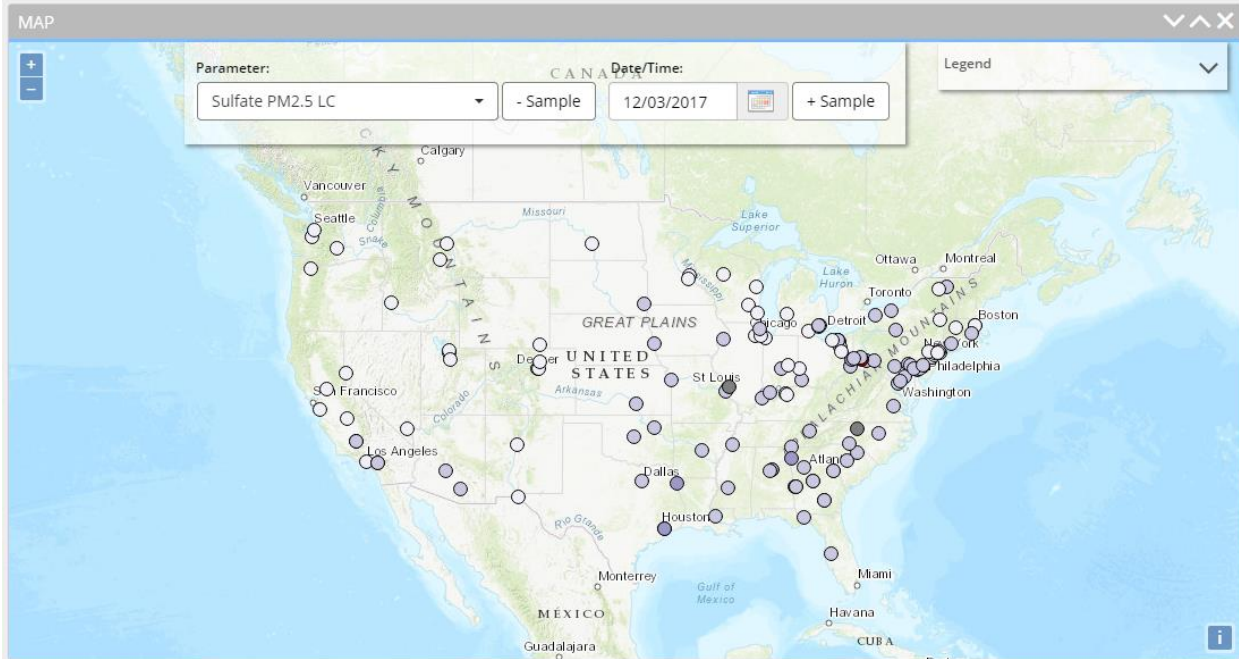
The stacked bar plot defaults to display the concentrations of the major components of the PM<sub>2.5</sub> mass for each sample in the data batch. The major components include ammonium sulfate,

ammonium nitrate, soil, organic carbon mass (OMC), chloride (multiplied by 1.8), elemental carbon (EC), and the difference in mass (calculated as the measured PM<sub>2.5</sub> mass minus the reconstructed mass).

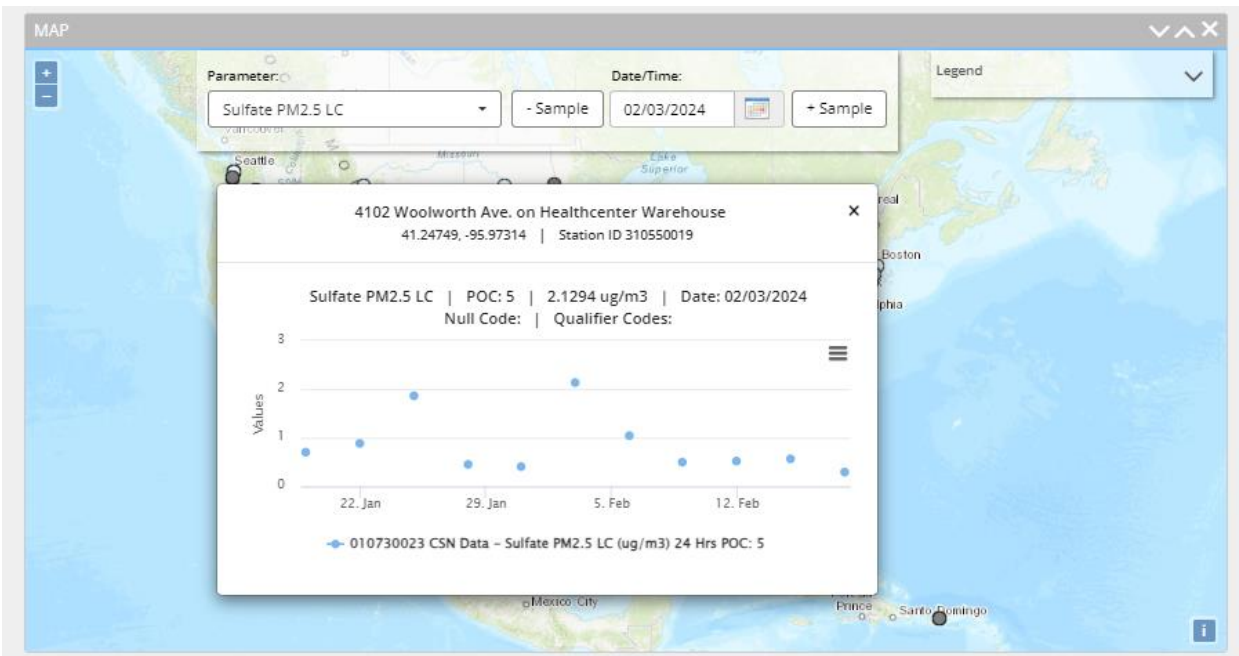


### 6.4.3 Map

The map helps you to visualize spatial patterns across the CSN network and in the region around your CSN site(s). The map defaults to display the concentrations of sulfate at all CSN sites across the country. Use the **Parameter** drop-down menu to select the parameter to display. Click the **+/- Sample** buttons (or use the **calendar** icon) to display concentrations for different sample dates.



Click on a site on the map to view a time series with the concentrations for the samples at the selected site.

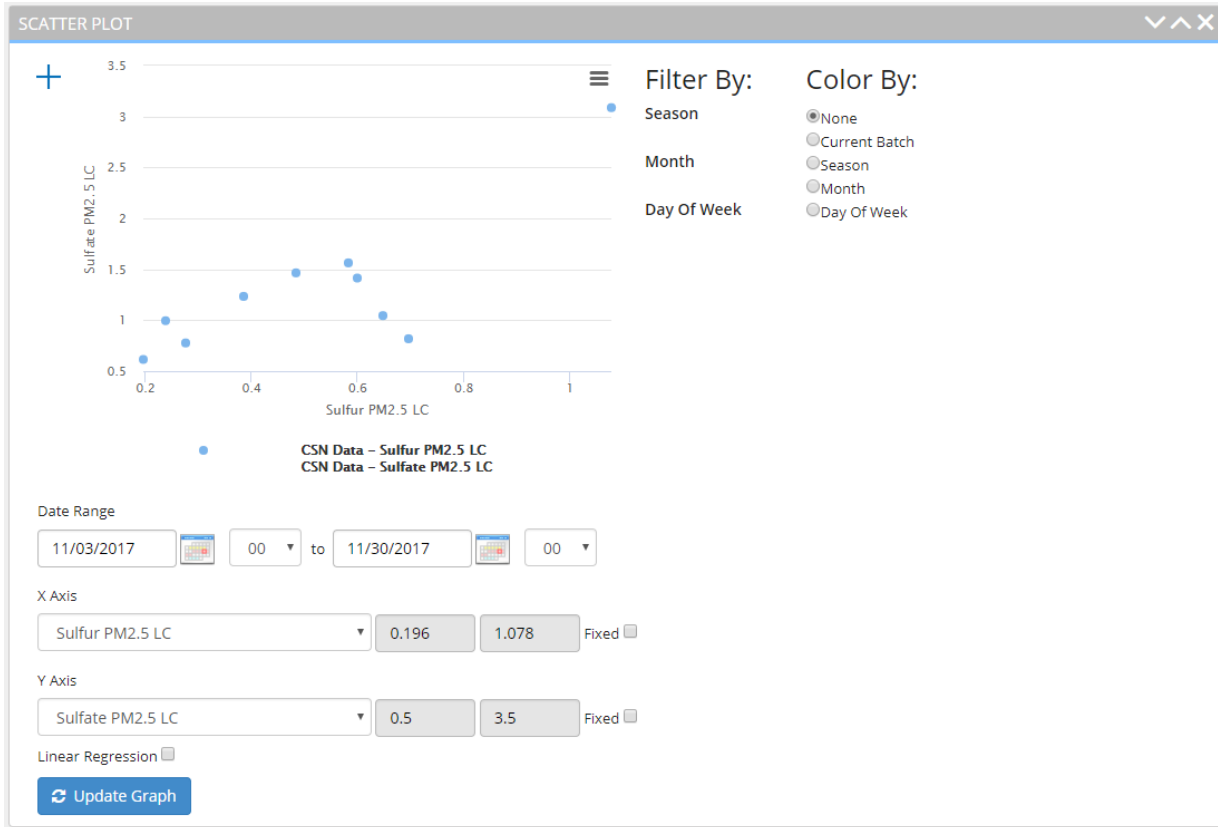


### 6.4.4 Scatter plot

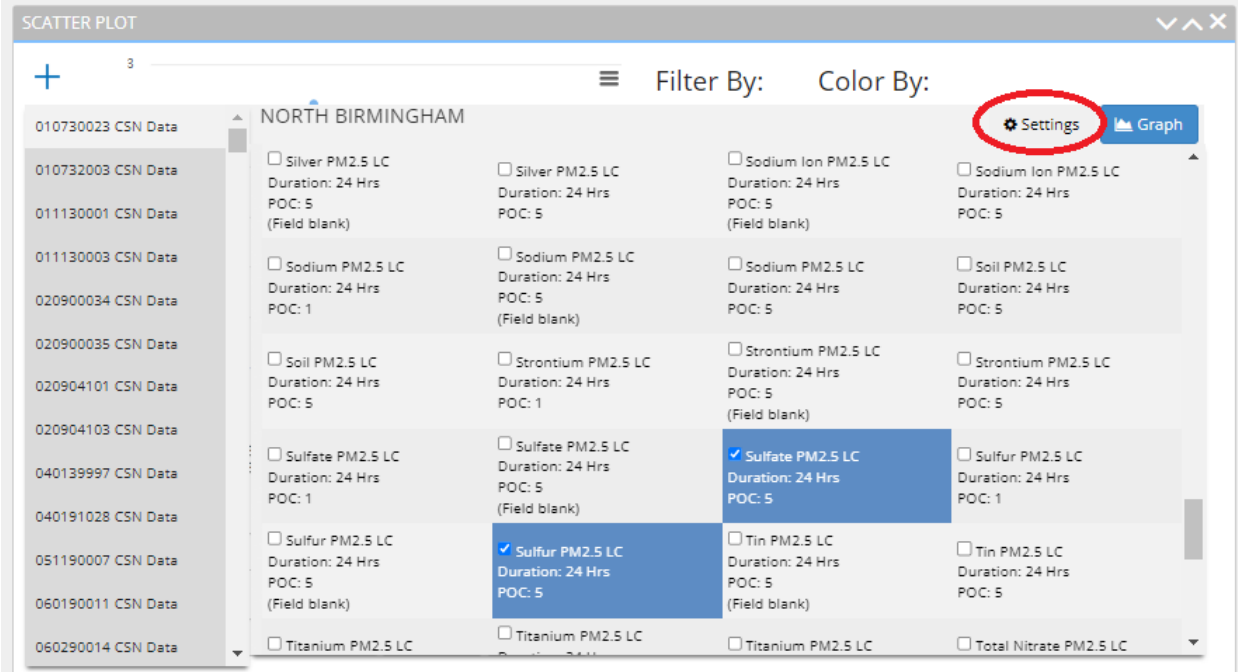
Scatter plots help you understand the relationship(s) between species. The scatter plot defaults to display the concentrations of sulfur (S) and sulfate (SO<sub>4</sub>). The sulfur values are multiplied by 3. The



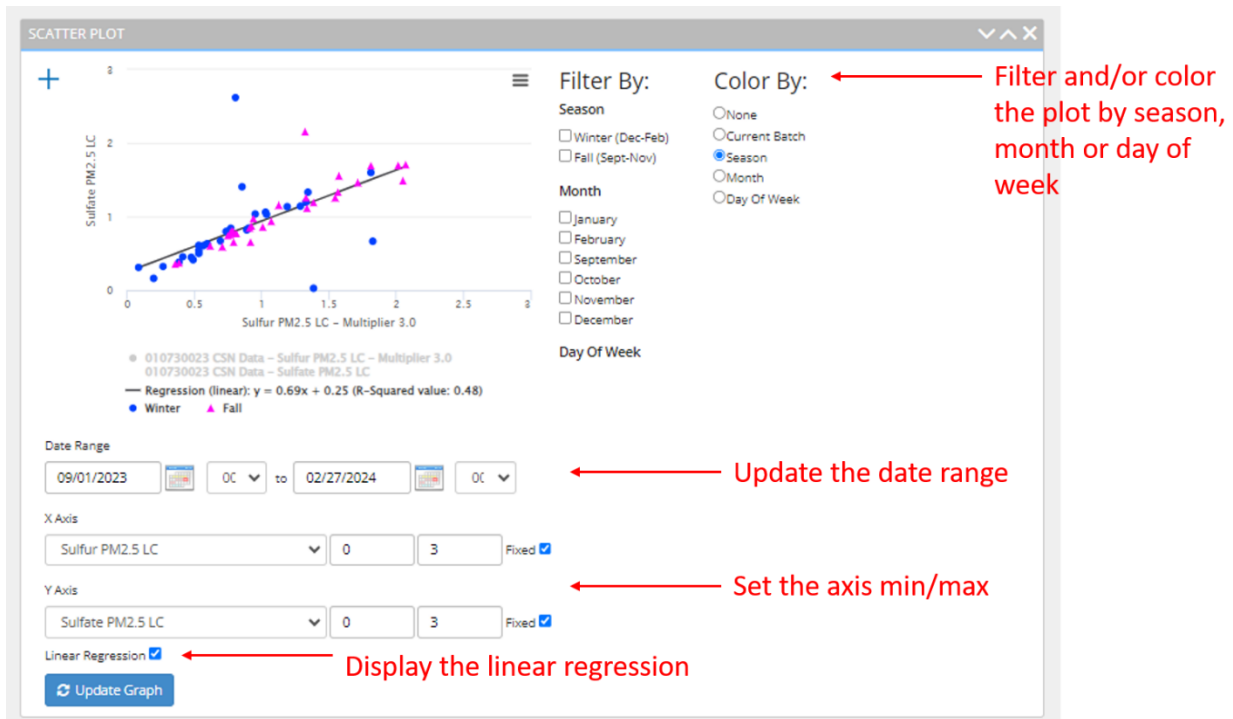
molecular weight of SO<sub>4</sub> is three times the atomic weight of S; the concentration ratio (3×S)/SO<sub>4</sub> should be one if all particulate sulfur is present as water-soluble sulfate.



Click the **Plus** icon and then click **Settings** in the top right portion of the menu to update the multiplier.

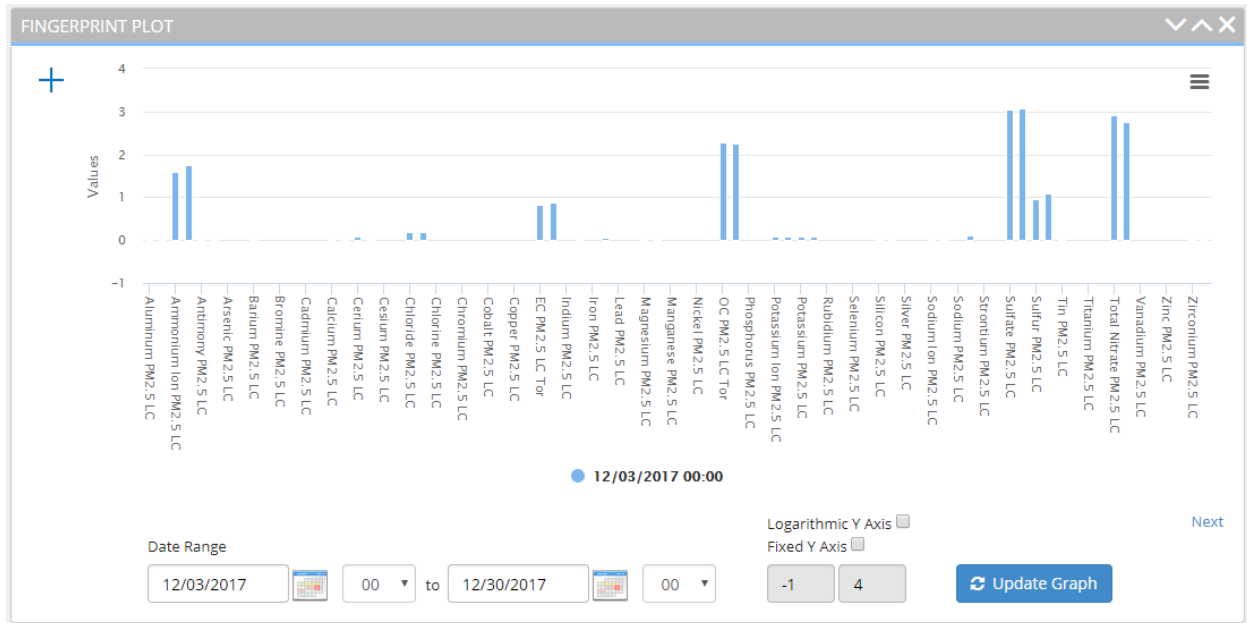


To assess long-term patterns, click the **calendar** icons to increase the time period displayed. Optionally, **filter and/or color** the plot by season, month, or day of week. The **linear regression** line can also be displayed.



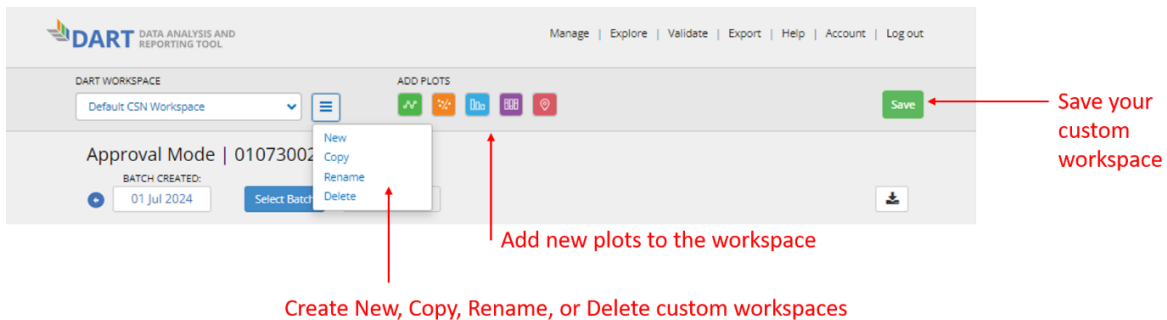
## 6.4.5 Fingerprint plot


Fingerprint plots can help you understand the relative magnitude of your parameter(s) over time and to visualize all species for a sample date simultaneously. To toggle through time, use the **Next** or **Previous** links.



## 6.5 Custom Workspaces

By default, **Approval Mode** displays the suite of plots setup in the **Default CSN Workspace**. You can customize and save multiple additional workspaces with your own plots.




Click the **hamburger menu**,  located next to the **Workspace** drop down, to create a new workspace, to copy an existing workspace (the one selected in the drop down), to rename a workspace, or to delete a workspace. Click any of the **plot** icons to add time series, scatter plot, fingerprint plot, stacked bar, or a map. Click **Save** to save the workspace for repeat use after customizing your plots.

# 7. DART Emails for CSN

As part of the CSN validation process, DART sends automated emails to CSN validators and any DART users that have been configured to receive CSN emails (see Section 4.2). An email is sent:

- When a new CSN data batch is received from the analytical laboratory and available for review in DART;
- When there are two weeks remaining in the 30-day review window;
- When there is one day remaining in the 30-day review window;
- When the 30-day review window has ended.

The DART emails include the review by date, the date range of the data batch available for review, and a table of information about each CSN site with data to review for your agency. The information includes the number of samples in the data batch, percent of data completeness, percent of data flagged with null or qualifier codes, percent of data above detection limits, the review status, and a link to the DART **Approval Mode** webpage for the site and batch.

 New batch of CSN data!  
! If there are problems with how this message is displayed, click here to view it in a web browser.

---

Dear DART User,

You have a new batch of CSN data waiting for you to approve in [DART](#). These data are available until 11:59 pm on **Wednesday, July 31, 2024**; upon expiration, the data are returned to UC Davis and submitted to AQS.

Your current batch of CSN data has samples for 7 sites from 02/03/2024 to 02/27/2024.

Site Name (AQS Code)	Number of Samples	% Data Completeness	% Data Flagged with Null Codes	% Data Flagged with Qualifier Codes	% Data Above Detection	Review Status	URL to Batch
IS 52 (360050110)	9	99	1	74	62	!	<a href="#">DART Batch</a>
ROCHESTER 2 (360551007)	9	91	9	43	62	!	<a href="#">DART Batch</a>
BUFFALO (360290005)	4	96	4	47	67	!	<a href="#">DART Batch</a>
PINNACLE STATE PARK (361010003)	9	99	1	44	57	!	<a href="#">DART Batch</a>
WHITEFACE BASE (360310003)	4	100	0	44	56	!	<a href="#">DART Batch</a>

## 8. More DART Tools

DART includes additional webpages (**Explore**, **Validate**, and **Export**) to support data validation. CSN data received by DART from the analytical laboratory for routine PM<sub>2.5</sub> review for CSN are not currently accessible from the other DART webpages. You can upload your own data files, or request data from AQS, to review using the other DART webpage. Please see the DART for PAMS User's Guide for more information.



## 9. More Information

Additional resources about CSN data validation and DART are available.

The EPA website for CSN includes general information, program guidance, and training materials at <https://www.epa.gov/amtic/chemical-speciation-network-csn>.

The Air Quality Research Center at the University of California, Davis (the analytical laboratory for CSN) maintains a documentation archive at <https://airquality.ucdavis.edu/csn-documentation> The archive includes:

- [CSN Validation Guide](#)
- [Quick Start Guide](#)
- Training videos
- Data advisories

Information about EPA AQS including parameter AQS codes, null codes, and qualifier codes is available at <https://www.epa.gov/aqs/aqs-code-list>.

## Appendix A.

Speciation parameters in the Chemical Speciation Network (CSN) are collected from three different filter types using different measurement methods:

- PTFE – species measured on PTFE using X-Ray Fluorescence (XRF) and Hybrid Integrating Plate and Sphere (HIPS)
- Nylon – species measured on Nylon using Ion Chromatography
- Quartz – species measured on Quartz using Thermal/Optical Analysis

CSN parameters displayed in DART’s **Approval Mode** are listed in the table below, along with their classification.

Filter	Analysis Method	Type	Parameter	Reported to DART?	Reported to AQS?
PTFE	XRF	Element	Aluminum	Yes	Yes
PTFE	XRF	Element	Antimony	Yes	Yes
PTFE	XRF	Element	Arsenic	Yes	Yes
PTFE	XRF	Element	Barium	Yes	Yes
PTFE	XRF	Element	Bromine	Yes	Yes
PTFE	XRF	Element	Cadmium	Yes	Yes
PTFE	XRF	Element	Calcium	Yes	Yes
PTFE	XRF	Element	Cerium	Yes	Yes



PTFE	XRF	Element	Cesium	Yes	Yes
PTFE	XRF	Element	Chlorine	Yes	Yes
PTFE	XRF	Element	Chromium	Yes	Yes
PTFE	XRF	Element	Cobalt	Yes	Yes
PTFE	XRF	Element	Copper	Yes	Yes
PTFE	XRF	Element	Indium	Yes	Yes
PTFE	XRF	Element	Iron	Yes	Yes
PTFE	XRF	Element	Lead	Yes	Yes
PTFE	XRF	Element	Magnesium	Yes	Yes
PTFE	XRF	Element	Manganese	Yes	Yes
PTFE	XRF	Element	Nickel	Yes	Yes
PTFE	XRF	Element	Phosphorus	Yes	Yes
PTFE	XRF	Element	Potassium	Yes	Yes
PTFE	XRF	Element	Rubidium	Yes	Yes
PTFE	XRF	Element	Selenium	Yes	Yes
PTFE	XRF	Element	Silicon	Yes	Yes
PTFE	XRF	Element	Silver	Yes	Yes
PTFE	XRF	Element	Sodium	Yes	Yes
PTFE	XRF	Element	Strontium	Yes	Yes
PTFE	XRF	Element	Sulfur	Yes	Yes
PTFE	XRF	Element	Tin	Yes	Yes
PTFE	XRF	Element	Titanium	Yes	Yes
PTFE	XRF	Element	Vanadium	Yes	Yes

PTFE	XRF	Element	Zinc	Yes	Yes
PTFE	XRF	Element	Zirconium	Yes	Yes
PTFE	HIPS		Light Absorption Coefficient (Fabs)	Yes	Yes
PTFE	Gravimetric		PM2.5 Mass	Yes	Yes
Nylon	IC	Ion	Ammonium	Yes	Yes
Nylon	IC	Ion	Chloride	Yes	Yes
Nylon	IC	Ion	Potassium	Yes	Yes
Nylon	IC	Ion	Sodium	Yes	Yes
Nylon	IC	Ion	Sulfate	Yes	Yes
Nylon	IC	Ion	Nitrate	Yes	Yes
Quartz	Thermal/Optical	Carbon	EC TOR	Yes	Yes
Quartz	Thermal/Optical	Carbon	OC TOR	Yes	Yes
Quartz	Thermal/Optical	Carbon	EC TOR (unadjusted)	Yes	Yes
Quartz	Thermal/Optical	Carbon	OC TOR (unadjusted)	Yes	Yes
Quartz	Thermal/Optical	Carbon	OC1	No	Yes
Quartz	Thermal/Optical	Carbon	OC2	No	Yes
Quartz	Thermal/Optical	Carbon	OC3	No	Yes
Quartz	Thermal/Optical	Carbon	OC4	No	Yes
Quartz	Thermal/Optical	Carbon	OP TOR	No	Yes
Quartz	Thermal/Optical	Carbon	OP TOT	No	Yes
Quartz	Thermal/Optical	Carbon	EC1	No	Yes
Quartz	Thermal/Optical	Carbon	EC2	No	Yes
Quartz	Thermal/Optical	Carbon	EC3	No	Yes

Quartz	Thermal/Optical	Carbon	OC TOT	No	Yes
Quartz	Thermal/Optical	Carbon	EC TOT	No	Yes

Additional operational and calculated parameters are also available in DART; not all are delivered to AQS.

Category	Parameter	Occurrence	Deliver to AQS
Operational	Avg. Ambient Parameters*	Per sampler	<input checked="" type="checkbox"/>
	Sample Volume	Per filter	<input checked="" type="checkbox"/>
	Sample Flow Rate CV		<input checked="" type="checkbox"/>
	Transport Temperature		<input type="checkbox"/>
Analytical	33 Elements	Per filter	<input checked="" type="checkbox"/>
	Light Absorption Coefficient (Fabs)		<input checked="" type="checkbox"/>
	6 Ions		<input checked="" type="checkbox"/>
	2 Carbon (OC & EC)		<input checked="" type="checkbox"/>
Calculated	Ammonium Nitrate	Per filter	<input type="checkbox"/>
	Ammonium Sulfate		<input type="checkbox"/>
	Organic Mass Carbon		<input type="checkbox"/>
	Soil		<input checked="" type="checkbox"/>
	Reconstructed Mass	Per sample event	<input checked="" type="checkbox"/>
Measured	PM2.5 Raw Data (AirNow 24-hr Mass)	(where available)	<input type="checkbox"/>
	PM2.5 Speciation Mass (88502)		<input checked="" type="checkbox"/>

\* Average values recorded from the sampler, not calculated from min & max values.