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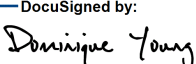

Data Preparation and Reporting  
UCD TI #351F, Version 1.1  
November 10, 2022  
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# UCD IMPROVE Technical Information #351F

## Data Preparation and Reporting

*Interagency Monitoring of Protected Visual Environments  
Air Quality Research Center  
University of California, Davis*

*November 10, 2022  
Version 1.1*

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**UC DAVIS**  
**AIR QUALITY RESEARCH CENTER**

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<b>Revision</b>	<b>Release Date</b>	<b>Initials</b>	<b>Section/s Modified</b>	<b>Brief Description of Modifications</b>
1.0	03/14/22	SRS	All	New TI created.
1.1	11/10/22	DEY, ITS	9.2	Updated procedure for compiling report.

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## 1. PURPOSE AND APPLICABILITY

The purpose of this technical information (TI) is to provide guidance on metadata creation, data creation and modification, and compilation of reports. This document is intended to guide users on creating box information in the University of California, Davis (UCD), Interagency Monitoring of Protected Visual Environments (IMPROVE) database and changing box metadata. In addition, the user is guided in the process of adding new site information to the UCD IMPROVE database and the EPA's Air Quality System (AQS) database. The procedure for compiling reports on the current status of the IMPROVE data is also included in this document.

## 2. SUMMARY OF THE METHOD

Requests are received from the UCD sample handling laboratory to assist with data preparation including creating boxes in the UCD IMPROVE database and modifying existing box information. Boxes are created and modified in the UCD IMPROVE database using the UCD IMPROVE Data Management website.

On a quarterly basis, the current status of the IMPROVE samples is reported to IMPROVE related personnel. The report is compiled using the IMPROVE Status Views website and is in an Excel spreadsheet format.

New IMPROVE sampling sites may start within the network; the site metadata is to be added to the UCD IMPROVE database directly using SQL queries, to AQS directly in the AQS application, if the data from the site is to be delivered to AQS, and the National Park Service (NPS) is to be informed of the new site metadata.

## 3. DEFINITIONS

- **AQRC:** Air Quality Research Center.
- **AQS:** EPA's Air Quality System database.
- **CSN and IMPROVE Archive (CIA) Database:** A database of the complete record of CSN and IMPROVE data coupled with a web-based visualization and analysis tool.
- **Chemical Speciation Network (CSN):** EPA's PM<sub>2.5</sub> sampling network, with sites located principally in urban areas.
- **CIRA:** Cooperative Institute for Research in the Atmosphere.
- **CSV:** a comma-separated value file that is the common format for delivery files.
- **Federal Land Manager Environmental Database (FED):** a database of environmental data managed by Cooperative Institute for Research in the Atmosphere (CIRA)
- **Ion Chromatography (IC):** An analytical technique used to determine the concentration of ions.

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- **Interagency Monitoring of Protected Visual Environments (IMPROVE):** Federal PM<sub>2.5</sub> and PM<sub>10</sub> sampling network directed by the National Park Service, with sites located principally in remote rural areas.
- **IMPROVE database:** A SQL Server database that is the central warehouse of IMPROVE preliminary and final data at UCD.
- **NPS:** National Park Service.
- **PM:** Particulate Matter. PM<sub>2.5</sub> is particulate matter with diameters 2.5 micrometers (µm) and smaller. PM<sub>10</sub> is particulate matter with diameters 10 µm or smaller.
- **SQL:** database management system used by AQRC.
- **UCD:** University of CA—Davis.

#### 4. HEALTH AND SAFETY WARNINGS

Not applicable.

#### 5. CAUTIONS

Not applicable.

#### 6. INTERFERENCES

Not applicable.

#### 7. PERSONNEL QUALIFICATIONS

The UCD Air Quality Research Center (AQRC) Data & Reporting Group staff assigned to tasks described in this document have advanced training in database programming and database management.

#### 8. EQUIPMENT AND SUPPLIES

The hardware and software used for IMPROVE data ingest are described in the associated *UCD IMPROVE SOP #351: Data Processing & Validation*.

#### 9. PROCEDURAL STEPS

##### 9.1 Data Preparation Tasks

###### 9.1.1 Box Creation

Occasionally, the box sent to the site by the sample handling lab is lost either before it reaches the site or after sampling and before being received back at the sample handling lab at UCD. For boxes that are lost prior to sampling, a replacement box is created and sent to the site as soon as the sample handling lab is alerted to the lost box. If the Data &

Reporting group are requested to assist in the creation of a new/replacement box, the following tool can be used: <https://improve.aqrc.ucdavis.edu/Operations/BoxSchedules>, which can be accessed by going to the IMPROVE Management Site, selecting the 'Operations' tab and the sub-tab of 'Schedule'. To create a box the following steps should be taken:

1. Go to the Box Schedules page and select the site via the drop-down menu next to 'Sampler' for which the new box is needed. Click on the 'Go' button to the right (Figure 1).
2. Scroll to the bottom of the page and click on the 'Add New Box' (Figure 1) button on the left.
3. This will lead to a 'Create Box' page as shown in figure XX. Enter the relevant date in the 'InstallDate' option and check 'this is a replacement box' option and click 'Create'. By selecting the replacement box option, the lab station Id will be set to pre weigh.
4. Select 'Add New Cartridge' and on the 'Create Cartridge' page that is subsequently opened, various cartridge information can be added including Sampler Module ID (e.g., 1A, 2B, 3C, 4D), Install Date (this is the cartridge install date and can be found in the IMPROVE calendar), and Schedule Week (i.e., Week 1, Week2, or Week 3). An example of install dates and schedule weeks is as follows: next upcoming box install date is on 04/20. The week 1 installment is 04/20, week 2 is 04/27, and week 3 is 05/04. The cartridge installment is always on a Tuesday regardless of it being a 2-3-2 or 3-2-2 box. Figure 2 shows an example of a Cartridge that is ready to be created. Once all relevant and required information is added, click on 'Create'.

Figure 1. Box creation page.

Improve Management Site | Home | Samplers | XRF | Analysis Data | **Operations** | Reports | Admin

Home | Alerts | Status | Exceptions | Pumps | Zeroes | Filter Readings | Import | Lab Humidity | Site History | **Schedule**

### Schedule

Search: Sampler: ACAD1 Start Date: 03/14/2021 End Date: 04/04/2021 Go Clear

Export Schedule: Module: 1 Master Index Start: 1 Export

Box (Id: 64536)

Sampler: ACAD1

InstallDate: 3/30/2021 12:00:00 AM

BoxStation: BoxReceiving

Details Edit

Add New Box

© 2021 - IMPROVE Data Management Application

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Figure 2. Cartridge creation page.

The screenshot displays the 'Create Cartridge' page within the IMPROVE Data Management Application. The top navigation bar is dark with white text for 'Improve Management Site', 'Home', 'Samplers', 'XRF', 'Analysis Data', 'Operations' (highlighted), 'Reports', and 'Admin'. Below this, a secondary navigation bar contains links: 'Home', 'Alerts', 'Status', 'Exceptions', 'Pumps', 'Zeroes', 'Filter Readings', 'Import', 'Lab Humidity', 'Site History', and 'Schedule' (highlighted). The main content area has a 'Back to Box' link and the title 'Create Cartridge'. The form includes the following fields:

- SampleBox**: ACAD1 - 4/20/2021 12:00:00 AM
- SamplerModuleId**: 1A (end: )
- InstallDate**: 04/27/2021
- ScheduleWeek**: 2

A 'Create' button is located at the bottom of the form. A second 'Back to Box' link is positioned below the form. At the very bottom, a copyright notice reads: '© 2021 - IMPROVE Data Management Application'.

5. Once the cartridge is added, individual filters can then be added, one-by-one, using the Add Filter feature on the page loaded after creating the cartridge. After clicking on 'Add Filter', the 'Create Filter' page is loaded. Every filter added requires the following information to be added: Cartridge Position (1, 2, or 3), Sample Date, Quarter Position (which can be found from the details of the lost box), Lot ID, and an indicator for whether it is a Moveable Cassette ('o-ring'). For the 2-3-2 boxes the Moveable Cassette will always be the third position of the second week. For the 3-2-2 boxes the Moveable Cassette will always be the third position of the first week. All four modules will have the Moveable Cassette on the same date (position); as the cartridges are cloned, this information will automatically be transferred. Once all information for a single filter is filled, click on the 'Create' button at the bottom of the page. A summary of the added filter is then displayed (Figure 3).
6. To add more filters, click 'Add Filter' at the bottom of the summary information. Repeat the instruction from step 5 to add the filter information. The number of filters to be added depends on whether it is a three- or two-position week. The box schedule can be found under the Cartridge Id details (near Module details; Figure 3). For a three-position week, three filters will need to be added and for a two-position week, two filters will need to be added.
7. Once a cartridge is created and all relevant filters have been added, the cartridge can be cloned to create cartridges for other modules by clicking the 'Clone' button to the right of the cartridge information on the Box Details page (Figure 3). The user should select the relevant Destination Module and Destination Lot from the drop-down menus and click 'Create'.
8. Repeat steps 4-7 to create the cartridges for the second and third week.

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9. Once the entire box has been created, the box details are to be send to the sample handling lab to add filter pre-weights and filter barcodes for the PTFE filters. Make sure the current lab station Id (as described in section 9.7.2) is set to 2 so the sample handling lab can assign the pre-weights accordingly. If the box was created in place of a lost box, please proceed to section 9.7.2 for further actions that need to be taken.
10. If an item needs editing or deleting at any point of the box creation, the edit/delete options on the right-hand side can be used accordingly (Figure 3). To delete a box, all cartridges must first be deleted. To delete a cartridge, all filters within the cartridge must first be deleted.

Figure 3. Box creation page; after addition of filter.

Improve Management Site Home Samplers XRF Analysis Data **Operations** Reports Admin

Home Alerts Status Exceptions Pumps Zeroes Filter Readings Import Lab Humidity Site History Schedule

[Back to List](#)

### Box Details

**Box**
[Edit](#)
[Delete](#)

**Sampler:** ACAD1  
**InstallDate:** 3/22/2021 12:00:00 AM  
**BoxStation:** Not yet processed

**Cartridge (Id: 789184)**
[Edit](#)
[Delete](#)
[Clone](#)

**Module:** 1A **Schedule:** 2-3\*-2  
**InstallDate:** 3/22/2021 12:00:00 AM  
**ScheduleWeek:** 1

**Filters:**

**#1: (Id: 1876090)** **SampleDate:** 3/24/2021 12:00:00 AM,  
**Purpose:** SA, **Status:** SO, **QuarterPosition:** 6, **MovableCassette:** False
 [Edit](#)
[Delete](#)

**Sample Period:** Start: 3/24/2021 12:00:00 AM, Stop: 3/25/2021 12:00:00 AM, Duration: 24 hrs

[Add Filter](#)

[Add New Cartridge](#)

### 9.1.2 Changing Current Lab Station ID and Assigning UF

When a replacement box is created in the case when boxes are lost prior to sampling, there are several additional steps to be performed to correctly assign data and other information to both the new box and lost box.

- For the new box, the sample handling lab assigns filter pre-weights. The current lab station of the box needs to be PreWeigh (Station ID = 2) to enable the sample handling lab to assign the weights. The box creation tool has the option to set the current lab station Id to pre weigh. The field could be updated using the following

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query if it wasn't selected during box creation it can be changed by running the following SQL update query in the UCD database, where *NewBoxID* is the ID of the newly created box:

```
UPDATE [Improve_2.1].[filter].[SampleBoxes]
SET CurrentLabStationId = 2
WHERE Id = NewBoxID
```

Check the update was successful by performing a SQL select query e.g.:

```
SELECT *
FROM [Improve_2.1].[filter].[SampleBoxes]
WHERE Id = NewBoxID
```

- For the lost box, the current lab station needs to be updated to Finished (Station ID = 9). To do this, run the following SQL update query in the UCD database, where *LostBoxId* is the ID of the lost box:

```
UPDATE [Improve_2.1].[filter].[SampleBoxes]
SET CurrentLabStationId = 9
WHERE Id = LostBoxId
```

To check the update was successful, perform a SQL select query e.g.:

```
SELECT *
FROM [Improve_2.1].[filter].[SampleBoxes]
WHERE Id = LostBoxID
```

- For the filters in the lost box, the filter purposes are to be updated to UF (Unused/Lost Filter (Filter Purpose ID = 16) and can be updated using the following SQL update query, where *LostBoxId* is the ID of the lost box:

```
UPDATE f
SET f.FilterPurposeId = 16
FROM [Improve_2.1].[filter].[Filters] f
LEFT JOIN [Improve_2.1].[filter].[SampleCartridges] sc ON sc.Id =
f.SampleCartridgeId
WHERE sc.SampleBoxId = LostBoxID
```

After updating the filter purpose, review and confirm the filter purpose Id for the whole box is correct by running the following query.

```
SELECT *
FROM [Improve_2.1].[filter].[Filters] f
```

```
LEFT JOIN [Improve_2.1].[filter].[SampleCartridges] sc ON sc.Id =
f.SampleCartridgeId
```

```
WHERE sc.SampleBoxId = BoxID
```

## 9.2 Quarterly Field Status Report

A field status report is generated quarterly to report on the status of all samples collected across the network for the previous quarter. Site status is evaluated relative to the regional haze rule criteria. The following information outlines the steps to generate the report and the checks to perform before delivery.

1. First, process flow data using the SQL execution code or the Crocker flow processing function as described in section 9 of UCD TI# 351 B and process flows for the relevant date range to be covered in the quarterly field status report by changing the Start Date and End Date fields. Processing flows at this point ensures the most up-to-date flow data and subsequent statuses are reported.
2. Create the report spreadsheet:
  - For the first quarter of a new year, save a copy of the template report under another name, with the format of *IMPROVE Status Report YYYY Q#*. The template report is located at U:\IMPROVE\Status Reports\Status\_Report\_Template.xlsx. In the Site status report tab, update the year in the Terminal samples by quarter and percent complete by quarter columns to the current year. For example, for 2022, it should be A22, B22, C22, and D22.
  - For the second, third, or fourth quarter, find the last report and save it under a name indicating the relevant quarter number. Previous reports are located at U:\IMPROVE\Status Reports\Reports
  - In the report there are four tabs:
    - Site Status Report
    - Status Flag Table
    - Flag Definitions: available from the database,  
*SELECT \**  
*FROM [Improve\_2.1].[filter].[Statuses]*
    - Sampler Locations: Determine if any sites are new, re-started, or have stopped during the relevant quarter by reviewing the date information in the *[Improve\_2.1].[sampler].[Samplers]* and *[Improve\_2.1].[module].[Modules]* tables in the production database. The *sampler.Samplers* table gives the site installation date, while the *module.Modules* table lists the first sampling date.
3. Populate the report:

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- From the IMPROVE Status page (<https://shiny.aqrc.ucdavis.edu/ImproveStatus/>), access the Network Status and Network Timeline tabs
  - The Network Status tab provides a count of the different statuses used per site, the total number of terminal statuses, which quarter they occur in, the percent complete by quarter, and the number of consecutive invalid statuses. The status page has options to choose “filter status only”, “filter and flow statuses”, and “final statuses (filter, flow, and analysis statuses)”. For this report, the user is to only consider filter and flow statuses.
    - Change the Year and Ending Quarter fields to align with the reporting period.
    - Select the “filter and flow statuses” option from the Status Types drop-down menu.
    - Download the full table by clicking on the ‘Download’ button. A .csv file is downloaded.
    - Compare the columns in the Site Status Report tab to the content of the downloaded spreadsheet; add new columns to the Site Status Report tab as needed.
    - Compare the sampler details in the Site Status Report tab to the content of the downloaded spreadsheet; add sampler details to or remove sampler details from the Site Status Report tab as needed.
    - Confirm that included flags are allowed (for example, the RF flag is no longer used). Investigate cases where unallowed flags are applied; work with the Sample Handling Laboratory to resolve.
    - Add the flag, definition, and result to the Flag Definitions tab of the report spreadsheet if not already listed.
    - Copy/paste content from the downloaded spreadsheet to the Site Status Report tab.
    - Color the relevant fields:
      - Percent Complete by Quarter:
        - < 75%, yellow
        - < 50%, red
      - Consecutive Terminal Samples:
        - > 7, yellow
        - > 10, red
      - Annual Completeness:
        - < 75%, red
- Note that the Annual Completeness column should only be colored for the fourth quarter (Q4) report. Report uncolored values for the first, second, and third quarter reports.

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- Check formatting for consistency, including font style and type, coloring, and shading.
- Consecutive Terminal Samples may require merged cells to report a single number per row. Select all the cells to be merged; navigate to the MS Office Home tab and select Merge Across (drop down menu by Merge and Center); click okay for each row for the cells highlighted.
- Update the date and quarter details at the top of the Site Status Report tab.
- The Network Timeline documents the most severe filter status for each site and date. For this report, check the box to “Include flow statuses”.; Change the Year to be relevant.
- Do a search for NF statuses. If any NF statuses are found, process the flows again using the SQL execution code or the Crocker flow processing function. If the NF statuses are for the most recent quarterly period, run the code in SQL or R, changing the Start Date and End Date fields; accordingly, if successful, a date/time of completion will show in the window:

If the NF statuses are for a small set of filters/sites/dates, confirm why this is the case and edit the SQL execution code or input the appropriate arguments in the Crocker flow processing code to run on the specified filter, date range, and/or site.

- Do a search for no statuses. For sites with no statuses, determine if it is a new site or a site that’s closed or if there is a reason such as paused shipments or the site temporarily offline.  
 If the site is new or closed, there may be blank records prior to the start date/ end date; if so, leave as-is but make sure the site is not falsely reported as failing the Regional Haze Rule criteria. Also check and ensure that the annual completeness column in Site status report tab is reported correctly.  
 If shipments are paused, work with the Software & Analysis Group and Sample Handling Laboratory; records may need to be added and/or the OL status may need to be manually inserted.
- If no NF or blank statuses are found, the data can be downloaded to be included in the report. There is a checkbox option defaulted to include the collocated module data on the network timeline page. As the Network Status page does not include statuses of filters from collocated modules, the data downloaded from the Network Timeline page should also only use filter statuses from routine modules. To do this, unselect the ‘Include collocated modules’ option and download the data by clicking on the ‘Download’ button. The default name of the downloaded .csv filter is ‘IMPROVE\_network\_timeline.csv’. As the PHOE5 site is a

collocated site with all four modules, it is considered an independent site in the Network Status table. To include the data from this site in the quarterly report, re-select the 'Include collocated modules' option and download the file by clicking on the 'Download' button. The file name is 'IMPROVE\_network\_timeline\_cl.csv'. Copy the line containing the PHOE5 information from this file and paste/insert it into the IMPROVE\_network\_timeline.csv file in the row under PHOE1.

- Compare the site list from the IMPROVE\_network\_timeline.csv with the sites listed in the Sampler Locations and Status Flag Table tabs in the Site Status Report tab. Update site and date information as needed after confirming with the Lead QA Officer; some sites are for special studies and are not included in this report.
- Copy/paste all content from the IMPROVE\_network\_timeline.csv to the Status Flag Table tab.
- Color the relevant fields:
  - QD, TO, CG, and LF flags, yellow
  - Null/terminal flags, red

4. Perform checks prior to delivery:

- Verify that the color coding is correctly assigned.
- Status Flag Table tab: Look for blocks of red (invalid) and SO flags. Investigate using JIRA and/or follow up with the Sample Handling Laboratory.
- Status Flag Table tab: Spot check to ensure that the number of terminal flags is corresponding to those reported in the Site Status Report tab.
- Status Flag Table tab: Confirm that the sites listed are also shown in the Site Status Report tab and the Sampler Locations tab.
- Flag Definitions tab: Confirm that the formatting and color coding is correct.
- Sampler Locations tab: Confirm that new sites have been added.

5. Send to the Data & Reporting Group Manager for review.

6. Once reviewed and approved, the Data & Reporting Group Manager will deliver to various personnel including IMPROVE site operators, NPS, and EPA staff via email. A summary of site losses is to be included in the body of the email.

### 9.3 Adding AQS Site Information

Whenever a new site starts within the network and the data will be delivered routinely to AQS, both the UCD database is to be updated with AQS related information and the AQS database is to be updated to add the new site and its associated monitors (where monitors are the AQS term for parameters). The site details should also be sent to NPS prior to data delivery when a new site starts sampling.

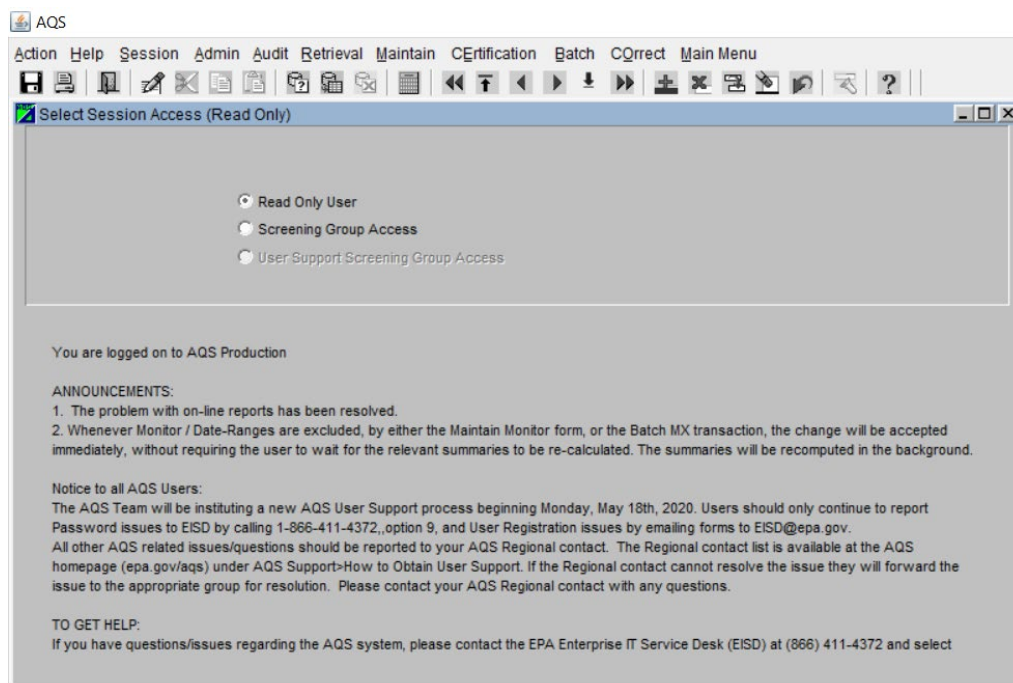
### 9.3.1 Updating UCD Database

#### 9.3.1.1 AQS Site ID

An AqsSiteId needs to be assigned to the new site in the sampler.Samplers table in the UCD database (Improve\_2.1), which consists of State Code, County Code, and Site Id. Further information can be found in sections 3.2.3-3.2.5 of the AQS Data Coding Manual ([https://www.epa.gov/sites/production/files/2015-09/documents/aqs\\_data\\_coding\\_manual\\_0.pdf](https://www.epa.gov/sites/production/files/2015-09/documents/aqs_data_coding_manual_0.pdf)). If the state and county where the site is located are known, then the associated codes can be found by searching FIPS online (Federal Information Processing Standards/Series, e.g. [https://geonames.usgs.gov/apex/f?p=138:1:::NO:1:P1\\_SHOW\\_FIPS55,P1\\_SHOW\\_ADV,P1\\_SHOW\\_ANTAR:Y,,](https://geonames.usgs.gov/apex/f?p=138:1:::NO:1:P1_SHOW_FIPS55,P1_SHOW_ADV,P1_SHOW_ANTAR:Y,,)). The user should query the AQS database to determine if a site already exists at the same location. To do this, the user should follow these steps:

- Log into the AQS application
- Select the Read Only User option (Figure 4)
- Go to Maintain
- Select Monitor (Figure 5)
- Type in the State Code and County Code
- Click on the ‘Execute Query’ button.

Figure 4. AQS screen after logging into the application; select the Read Only User option.



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Figure 5. AQS screen after selecting Monitor from the Maintain option.

The site does not already exist in AQS if no results are returned. If any results are returned, the user should review the details to confirm if the parameter code and/or the POC is one that is reported as part of the IMPROVE network. By convention, if the site does not already exist in AQS, the Site Id assigned is ‘9000’. The user should repeat the steps above to include the Site Id of ‘9000’ and executing the query again to confirm the site and/or monitors does not already exist.

Another way to check what site IDs are already in use and thus what are ‘available’ is to review the ‘Site Listing’ spreadsheet via [https://aqsweb.airdata/download\\_files.html#Meta](https://aqsweb.airdata/download_files.html#Meta). Note that this is updated only every 6 months so it may not be the most up-to-date. By convention

CDPHE uses the lower site numbers and NPS has used the 9000 series. Reach out to NPS, CIRA and air-resources to confirm what site Id's are already in use.

If 9000 is already in use, get the next available count, make sure it's not already in use, and confirm with various agencies (eg. CDPHE) that we are not in conflict with anyone.

Once the State Code, County Code, and Site Id are known, the UCD database can be updated as follows:

- Query the database using the following SQL query to find the relevant site record, where 'XXXX#' represents the four-character site name plus the number, typically 1.

```
SELECT *
FROM [Improve_2.1].[sampler].[Samplers]
WHERE Name = 'XXXX#'
```

- Update this site record with the newly generated AQS site ID, a nine-digit ID comprising the State Code, County Code, and Site ID, with no separation.

```
UPDATE [Improve_2.1].[sampler].[Samplers]
SET AqsSiteId = '#####'
WHERE Name = 'XXXX#'
```

#### 9.3.1.2 AQS Parameters and POCs

In addition to updating the Samplers table in the database with the AQS site ID, POCs (Parameter Occurrence Code) need to be added to the analysis.AqsPOCs table. In AQS, POCs are assigned per parameter. If there was no existing site in AQS, POC = 1 for all parameters, except for the coarse mass parameter (PM<sub>10</sub>-PM<sub>2.5</sub>), which is assigned POC = 5 by convention. If there are existing collocated sites in AQS, the next smallest different number is to be used, e.g. POC = 2.

To add the parameters and POCs to the database, specifically the *analysis.AqsPOCs* table, a SQL insert query can be written using the starting format below where each set of values is for a different parameter:

```
INSERT INTO [Improve_2.1].[analysis].[AqsPOCs] (SamplerName, ObjectiveCode,
Parameter, POC)
```

```
Values (SamplerNameX, ObjectiveCodeX, ParameterX, POCX), (SamplerNameX,
ObjectiveCodeX, ParameterY, POCX), ...
```

Alternatively, to add to the database in bulk, an R script can be written and used, ensuring that the outputs from each step of the script is reviewing along the way.



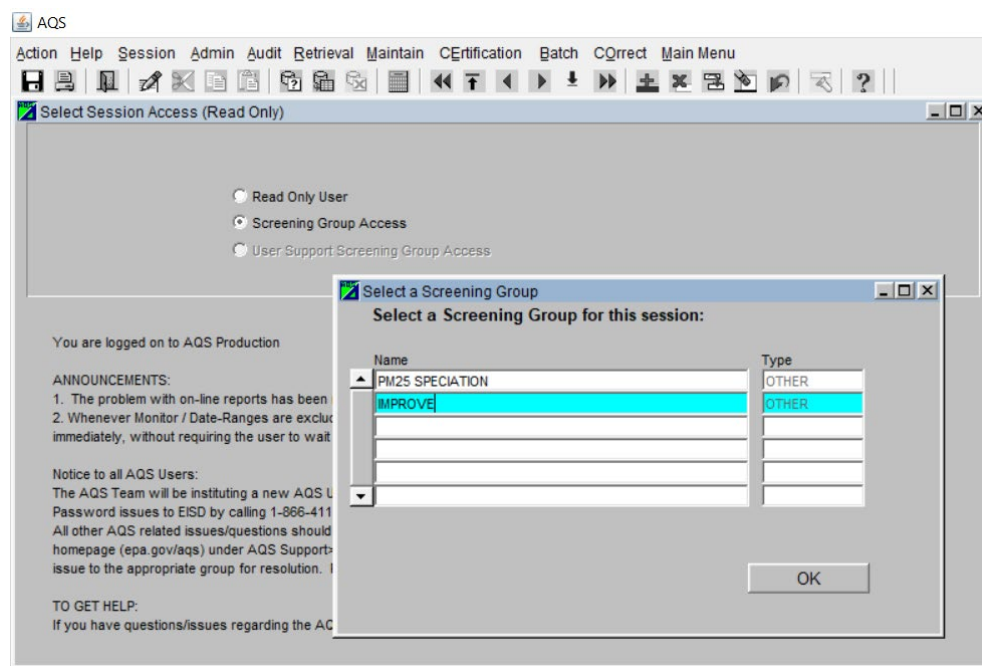
## 9.3.2 Adding Site and Monitors to AQS

### 9.3.2.1 Adding a New Site to AQS

To add a new site to AQS the user should follow the steps below:

- Log into the AQS application
- Select the IMPROVE Screening Group Access option (Figure 6)
- Go to Maintain
- Select Site
- Click 'Cancel Query' (Figure 7).
  - This allows the user to click on the 'Check Validity' button at the bottom of the window once various details have been entered.

Figure 6. AQS screen after logging into the application; select the Screening Group Access option and then IMPROVE.



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Figure 7. AQS screen after selecting Site from the Maintain option and clicking Cancel Query.

The fields to be completed are detailed below:

- Site Identification
  - The State Code, County Code and Site Id should all be known from the previous section. Enter the codes; the associated names will fill automatically.
- User Coordinates
  - Horizontal Datum: WGS84 (by convention).

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- Latitude and Longitude: find in the IMPROVE Data page, under Sites, select the relevant site. Note that W longitude should be entered as negative. i.e., 105 W is entered as -105.
- Horizontal Method: 103(GPS) (by convention).
- Horizontal Accuracy: 5 meters (by convention).
- Source Map Scale (Non-GPS): 10000 (by convention)
- Vertical Measures: Site elevation; find in the IMPROVE Data page, under Sites, select the relevant site.
- Vertical Accuracy: 5 (by convention).
- Vertical Datum: NAVD88 (by convention).
- Vertical Method: 001 (by convention).
- Street Address: If not already known, the site operator may have to be contacted to obtain this information.
- Land Use Type: If not already known, the site operator may have to be contacted to obtain this information. Options for this field are: Residential, Commercial, Industrial, Agricultural, Forest, Desert, Mobile, Blighted Areas, Military Reservation.
- Location Setting: If not already known, the site operator may have to be contacted to obtain this information. Options for this field are: Urban and center city, Suburban, Rural.
- AQCR Code: Use the drop-down menu, select the code listed; there should only be one.
- Site Established Date: Find in the sampler.Samplers table in the UCD database.
- Time Zone Name: Use the drop-down menu, select the option listed.

Owning Agency: If not already known, the site operator may have to be contacted to obtain this information. To search for the agency and obtain the relevant agency code, use the drop-down menu and in the 'Find' box, type in the details of the agency (Figure 8) and select the appropriate affiliation from the returned results.

Figure 8. AQS screen when searching for Owning Agency details.

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Once all the fields have been entered, the user should click ‘Check Validity’ at the bottom of the screen. A ‘Row\_Errors’ window may appear with Error Descriptions left blank. If not blank, the user should return to the Site’s window and correct the errors. Upon completion, the details are saved by clicking on the save button at the top left of the AQS window (under ‘Action’). Follow any additional prompts, e.g. click ‘Lookup Geography’, and save again.

For confirmation the site is saved, the user should navigate to a fresh Maintain Site window, enter the State Code, County Code, and Site Id and execute query. The full site details should be displayed and the Status Ind should have changed from ‘F’ to ‘P’, meaning the site is now in production.

### 9.3.2.2 Adding Monitors to AQS

In addition to opening the parent site, the monitors (parameters) need to be opened. There are two methods for adding monitors: Batch processing (preferred because of high efficiency) and manually adding monitors, one at a time.

For batch processing, the user should follow these steps:

- Navigate to the template text file, monitor\_template.txt, at U:\IMPROVE\AQS\AQS\_Documentation.
- Save this as a new file, with a file name that indicates which site it is for.
- Update the State Code, County Code, Site Id, and POC, if necessary by performing a ‘Find and Replace’ in Notepad (or other application).

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- If this is a new site, then the only date in the file should be updated to be the site start date. If the site is being closed, then an end date needs to be added as well (this field is currently blank in the template).
- Navigate to the Exchange Network website and submit the file in the same way that raw data is delivered as described in section 9.4.2.

To add monitors manually, one at a time, the user should follow these steps:

- After adding the site to AQS as detailed in section 9.6.2.1, the user should ensure they are in the IMPROVE Screening Group Access session and navigate to the Maintain Monitors window (Figure 5).

The following details the information that must be added to each specified tab to open a parameter (monitor):

- Monitor Basic: enter State Code, County Code, Site Id, Parameter Code, and POC for the parameter that is being opened.
- Sample Period: enter the date used for 'Site Established Date' when creating the site in the 'Begin Date' field.
- Type Assign: enter 'EPA' as the Monitor Type and Begin Date is the same date as the Site Established Date.
- Network Affiliations: enter 'IMPROVE' for the Monitor Network Code and the Begin Date.
- Agency Roles: enter a row each for Agency roles of ANALYZING, COLLECTING, REPORTING and PQAO, list the Agency Code as '0745', and the Begin Date. If the Site Established Date is before 2007-01-01, the Begin Date should be entered as '20070101'.
- Objectives: select 'GENERAL/BACKGROUND' and enter '0000' for the UA Represented field.

The user should save the entry and confirm that the 'Status Ind' in the Monitor Basic tab is 'P'. To add more monitors for the same site, the user should click on the 'Duplicate Monitor' option at the bottom of the Monitor Basic tab and enter the appropriate parameter code details. The user should follow these steps until all relevant monitors are opened.

### 9.3.3 Updating NPS

The NPS needs to have the site details for any new site that starts sampling in advance of data delivery. The NPS requires the following information be sent:

- Site Name
- State
- County
- AQS Code
- Latitude

- Longitude
- Elevation
- Start Date
- End Date (assumed to be blank at present)
- Sponsor/Agency
- Location Description
- Rural or Urban (or other demographic code)
- Land Use code, if any
- Photos of the site.

#### 9.3.4 Updating UCD-CIA Database

Whenever a new sampler is added, the sites table in the UCD-CIA database needs to be updated. The request should be directed to the software group. The software group uses the EPA's master AQS site list to add information to the database. If a new sampler is not added to the UCD-CIA database prior to data submission, the data will stage but will not migrate. Once the relevant sampler information is added to the database, the staged data will successfully be posted to the UCD-CIA database when the SQL query to migrate data is next run (typically every night).

## 10. QUALITY ASSURANCE AND QUALITY CONTROL

### 10.1 Code Development

Software for data management, processing, and validation is developed in-house by professional software engineers. Source code is managed through a code repository. Development of code changes and new applications is conducted on a development environment that parallels the production environment. Prior to deployment in production, all code changes undergo testing within a separate test environment. The testing, which is conducted by developers, managers, and users, is targeted both at the identification of software bugs and the confirmation of valid data equivalent to the production system.

### 10.2 Bug Reporting

Software bugs and data management issues are tracked through JIRA tracking software. All UCD users have access to an internal JIRA website and can submit, track, and comment on bug reports.

### 10.3 Data Validation

Data integrity is enforced within the UCD IMPROVE database via unique primary keys and non-nullable records. Data completeness and data quality are thoroughly checked through the data validation process, as described elsewhere in this SOP.

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## 11. REFERENCES

*UCD IMPROVE SOP #351: Data Processing and Validation*