

# North Carolina Department of Environmental Quality Division of Air Quality Standard Operating Procedure 2.63.4 Section 4: Standard Operating Procedures for Validation of Particulate Matter



North Carolina Department of Environmental Quality Division of Air Quality 1641 Mail Service Center Raleigh, North Carolina 27699



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\_\_\_\_\_\_ Aug 12, 2020

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## Sign Off Page

I certify that I have read and approve of the contents of the Standard Operating Procedure for Validation of Particulate Matter with an effective date of August 1, 2020.

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## 2.63.4.1 Scope and Purpose

This document serves as a guide for the Raleigh Central Office (RCO) PM Chemist to review, document and validate particulate matter (PM) data in the North Carolina Division of Air Quality (NC DAQ) Monitoring Network. It provides routine operating procedures to achieve uniformity and ensure a high level of quality data produced in the course of operations. Several other documents are encouraged to be used in this review, including but not limited to:

- The Code of Federal Regulations (CFR),
- The EPA (Environmental Protection Agency) Quality Assurance Handbook for Air Pollution Measurement Systems Volume II,
- The Quality Assurance Project Plan for the North Carolina Division of Air Quality Particulate Matter Monitoring Program (QAPP),
- Operator's Standard Operating Procedures (SOP) and
- Manufacturer's operator's manual.

## 2.63.4.2 Personnel Qualifications

The user of this document should have a general working knowledge of Air Quality regulations, be familiar with software NC DAQ may use regularly such as Envidas, Envista, IBEAM, MS Office and EPA-AQS (Air Quality Systems).

## 2.63.4.3 Description of the PM Monitor Network

The NC DAQ PM monitoring network uses only EPA-approved FRM (Federal Reference Method) or FEM (Federal Equivalent Method) instrumentation for determining pollutant concentrations for NAAQS (National Ambient Air Quality Standard) compliance. Listed in table 1 are the types of instrumentation in the NC DAQ PM Monitoring Network. Note: The NC DAQ may use alternative non-FEM or non-FRM methods for Air Quality Index (AQI) reporting.

		AQS Method	EPA Reference/
Pollutant	Analyzer/Monitor/Sampler	Codes	Equivalence
PM <sub>2.5</sub> local	Rupprecht and Patashnick Partisol-Plus	145	RFPS-1006-145
conditions,	Model 2025 Sequential Air Sampler		
filter based	(with PM <sub>10</sub> head and VSCC)		
	Thermo Model 2025 i Sequential Air		
	Sampler		
	(with PM <sub>10</sub> head and VSCC)		
PM <sub>2.5</sub> local	Met One BAM 1020 (with PM10 head and	170	EQPM-0308-170
conditions,	VSCC)		
continuous	Met One BAM 1022 (with PM10 head and	209	EQPM-1013-209
	VSCC)		
	Teledyne T640X (with PM10 head)	236	EQPM-0516-236

Table 1- Instrumentation in the NC DAQ PM Monitoring Network

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	umentation in the NC DAQ PM Monitoring N		
		AQS Method	EPA Reference/
Pollutant	Analyzer/Monitor/Sampler	Codes	Equivalence
PM <sub>10</sub> local	Met One Instruments BAM 1020 (with	122	EQPM-0798-122
conditions,	PM <sub>10</sub> head alone)		
continuous	Teledyne T640X (with PM <sub>10</sub> head)	238	EQPM-0516-238
$PM_{10}$ STP,	Met One Instruments BAM 1020 (with	122	EQPM-0798-122
continuous	PM <sub>10</sub> head and downtube)		
	Teledyne T640X (with PM <sub>10</sub> head)	239	EQPM-0516-239
Acceptable	Met One BAM 1020 (with PM <sub>10</sub> head and	733	Not a reference
PM <sub>2.5</sub> AQI	VSCC)		method
_	Met One BAM 1022 (with PM10 head and	733	
	VSCC		
	Met One BAM 1022 (with PM10 head and	171	
	SCC)		
PM10-2.5,	Met One BAM 1020	185	EQPM-0709-185
local	(one unit with PM <sub>10</sub> head and VSCC paired		
conditions	with a unit with PM <sub>10</sub> head alone)		
continuous	Teledyne T640X (with PM <sub>10</sub> head)	238	EQPM-0516-238
PM2.5	CSN(Chemical Speciation Network) URG	838	Not a reference
speciation			method
carbon			
compounds			
local			
conditions,			
filter based			
PM2.5	CSN-MetOne SASS	812	Not a reference
speciation			method
cations and			
anions local			
conditions,			
filter based			
PM2.5	CSN-MetOne SASS	811	Not a reference
speciation			method
metals local			
conditions,			
filter based			
	·	•	

Table 1- Instrumentation in the NC DAQ PM Monitoring Network

Data collected from the NC DAQ PM monitoring network are categorized into two general categories:

<u>- Intermittent sample collection (non-continuous or static)</u> – Where a physical sample is collected using a monitoring device that passes ambient air through a filter, collects a sample in a container, or exposes a sample collection media to a sample stream. The sample containing media (i.e., filter) is then removed and analyzed via laboratory methods to identify and/or quantify the pollutant of interest.

- <u>Real-time or near real-time sample analysis (continuous)</u> – Where physical samples are not collected. Instead, the analyzer itself performs "In situ" analysis of the composition of the sample using a specific methodology. The next subsections describe the process of how non-continuous and continuous PM data are validated.

## 2.63.4.4 Validation of Non-Continuous PM Data

 Site Validation Checklist Set-Up: Validation of non-continuous PM data begins with obtaining a copy of the latest version of the FRM Validation Template. The most current version of the template is stored in IBEAM (>Documents General:Work, >Search General Documents: Doc. Category:Ambient Work, Doc. Group: Templates, Doc. Type: Logbook Templates) or SharePoint (FRM Validation Template). Note: The template contains the same directions outlined in this SOP.

2) Save a copy of the validation template as FRM Validation XQ20XX (e.g. FRM Validation 4Q2017). Make a copy of the original Site Validation Checklist tab and rename it for the site you are reviewing (e.g. Spruce Pine). Fill out the Site Information section. Enter the first run day of the quarter for the sampling schedule needed.

	Site Information
Region:	WSRO
Site Name:	Lexington
AIRS #:	37-057-0002
Site ID2 #:	409
Reviewer(s):	PJC
Passed QA Date:	

Figure 1-Screen Shot of Site Information

3) Filter Sheet and IBEAM Completeness Review

As part of NC DAQs chain of custody procedure, every EPA sampling date and field blank must have:

- a) A filter sheet for that day,
- b) An IBEAM site data record for that run day with the corresponding filter number,
- c) And a lab data record for the filter that ran.

4) Using the 3-day or 6-day schedule generator in the checklist, ensure that there is a filter sheet for every EPA run date. While performing this task, confirm that a field

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blank was run during each month of the quarter for the sampler, and that a site trip blank was run once during the quarter for the site. Record these dates on the checklist.

6 - Day Schedule	Ran
1/4/20	▼
1/10/20	
1/16/20	•
1/22/20	◄
1/28/20	◄
2/3/20	

Figure 2-Screen Shot of 6-Day Schedule

Figure 3-Screen Shot of Filter Sheet and I-BEAM Completeness Review

Filter Sheet a	Yes	No				
Filter # and date on data sheet agrees with the field data in I-BEAM?						
All sampling occured on a 1:3 or 1:6 schedule? If not, see Misses Samples section.						
Field blanks: 1/month/sampler 1/23/20 2/28/20 3/29/20						
Trip blanks: 1/quarter/site 1/6/20 3/3/20						•
Blanks net mass are within ± 30 μg? <i>If greater, reweigh filter and review data.</i>						

 If a filter is missing for an EPA sample date, make sure the operator filled out a missing filter sheet for that day, or make one yourself using information from the site's e-log, and record the missed sample date, reason for missing, null code and make-up date in the Missed Samples and Sample Make-Ups section of the checklist.

Figure 4-Screen Shot of Missed Samples and Sample Make-Ups

Sample Date	Reason	Code	Make-up Date
		());;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	
1			

- 2) In IBEAM, go to **>PM 2.5 FRM**, **>Site Data View or Modify Records.** Select the appropriate site specific two letter code, ID2, start sample date and the end sample date of the quarter you are reviewing. Select **>Display**.
- 3) Reconcile the filter sheets to the filter data in IBEAM. Trip blanks will not be seen in this screen. Remedy any conflicts with run date and filter number by highlighting the record and selecting >Update selected record.

Site:	100			art Date						
Site Id2:	409	End End	Act St	art Date	: Mar 🗸	31 🗸 2019	✓ н	tecords: All		~
		Disp	olay							
						Set	Set	Act	Act	Set
Filter		Site	Site		Cassett	e Start	Start	Start	Start	Stop
Id	Site	e Idl	Id2	Poll	Id	Date	Time	Date	Time	Date
T8503367	LX	370570002	409	PM2.5	000000	01/03/2019	0:00	01/03/2019	0:00	01/03/2019
<b>T</b> 8503368	LX	370570002	409	PM2.5	000000	01/04/2019	0:00	01/04/2019	0:00	01/04/2019
T8503369	LX	370570002	409	PM2.5	000000	01/09/2019	0:00	01/09/2019	0:00	01/10/2019
	ΓX	370570002	409	PM2.5	000000	01/15/2019	0:00	01/15/2019	0:00	01/16/2019
T8503432	LX	370570002		PM2.5	000000	01/21/2019		01/21/2019		01/22/2019
T8503429	LX	370570002		PM2.5	000000	01/27/2019		01/27/2019	0:00	01/27/2019
T8503436		370570002				02/02/2019		02/02/2019		02/03/2019
T8503703		370570002		PM2.5	000000	02/08/2019		02/08/2019		02/08/2019
T8503704		370570002		PM2.5	000000	02/09/2019		02/09/2019		02/09/2019
T8503705		370570002				02/14/2019		02/14/2019		02/15/2019
<b>T</b> 8503706		370570002				02/20/2019		02/20/2019		02/21/2019
<b>T</b> 8503707	LΧ	370570002		PM2.5	000000	02/26/2019		02/26/2019		02/27/2019
T8503806		370570002				03/04/2019		03/04/2019		03/05/2019
T8503807		370570002				03/10/2019		03/10/2019		03/11/2019
T8503809		370570002			000000	03/16/2019		03/16/2019		03/16/2019
T8503930		370570002			000000	03/17/2019		03/17/2019		03/17/2019
T8503926	LX	370570002		PM2.5	000000	03/22/2019		03/22/2019		03/23/2019
T8503928	LΧ	370570002	409	PM2.5	000000	03/28/2019	0:00	03/28/2019	0:00	03/29/2019

Figure 5-Screen Shot of IBEAM Update Selected Record

- 4) Insert a missed day into I-BEAM by selecting >Insert missed day record. Input the make-up date, appropriate null code and comment from the Missed Samples and Sample Make-Ups section.
- 5) Delete any erroneous filters by highlighting the record and selecting **>Delete selected** record.
- 6) If a sample is missing in IBEAM, but occurs in the lab data and has a filter sheet, the field data can be uploaded via FTP (see below) or by selecting >Insert complete record.
- 7) In IBEAM, select >Reports, >Ambient Monitoring and run a "Noncontinuous Field and Trip Blanks". Select the region, start sample date and the end sample date of the quarter you are reviewing. Select >Run Report. Copy and paste the data from the Excel spreadsheet into the Blank Data Review tab of the template. Review to confirm that all field and trip filter blanks have not exceeded ± 30 µg. If an exceedance occurs, call the lab to have the blank reweighed. After the lab has reweighed the blank and it proves to be unacceptable, contamination during

transportation or at the sampling site may be occurring. Notify parties involved to take appropriate troubleshooting and corrective actions. Report the blank to AQS and apply the appropriate Qualifier Code to the data as needed. Use the **LB**-Lab blank value above acceptable limit, **FB**-Field blank value above acceptable limit, or **TB**-Trip blank value above acceptable limit, depending upon which blank has failed the acceptance criteria. The raw data must be flagged from the last passing blank to the next passing blank (usually for 2 months). Note: Blanks may be listed as runs by mistake in the lab data. Contact the lab for changes to the data. Run the report again. Blank data for the WNC program can be found on the "**Noncontinuous Lab Data**" report in IBEAM.

- 8) File Transfer Protocol (FTP) to IBEAM
  - a) To upload a field data file into IBEAM, open Filezilla.
  - b) Enter the following and click >Quickconnect:

Host:	
Username:	
Password:	

9) The following screen should appear. Under Remote Site, in the Filename window, select >aq>ambient>general>RegOffices>(Regional Office Name)>PM2.5frm.

Host:         p.daq.ncdenr.org         Username:         ambient         Password:           tatus:         Insecure server, it does not support FTP over TLS.         Logged in         Logged in           tatus:         Retrieving directory listing         Directory listing of "/" successful         Not connected×	••••	Port C	Quickconne	ct 💌		•
Local site: C:\Users\pjchappin\Desktop\	~	Remote site: /				~ ~ ~
IntelGraphicsProfiles       □ IntelGraphicsProfiles       □ Links       □ Links <th>*</th> <th>Filename - kde aq bets cs dpr_cm eep Files_for_Ron ais c</th> <th></th> <th>File folder File folder File folder File folder File folder File folder File folder</th> <th>Last modifi 5/27/2012 3/28/2013 1/20/2012 5/27/2012 5/27/2012 5/27/2012 5/27/2012</th> <th>F</th>	*	Filename - kde aq bets cs dpr_cm eep Files_for_Ron ais c		File folder File folder File folder File folder File folder File folder File folder	Last modifi 5/27/2012 3/28/2013 1/20/2012 5/27/2012 5/27/2012 5/27/2012 5/27/2012	F
104 files and 55 directories. Total size: 230,874,162 bytes Server/Local file Direc Remote file	Size	6 files and 21 directories. Total Priority Status	size: 811,2-	42,629 bytes		

Figure 6-Screen Shot of FileZilla

10) Under the Local site, in the Filename window, highlight the files to be uploaded. Click >Upload.

File Edit View						
		* 3	× ./	F 🔍 🔍	<b>6</b>	
Host: p.daq.ncder	nr.org Usernam	e: amb	ient	Password:	•••••	Port:
tatus: File tran	in download of /aq sfer successful, tra ected from server	nsferrec				n/DA 20190.
Not connected >	ambient@ftp.d	laq.ncde	nr.org ×			
Local site: C:\User	s\pjchappin\Desk	top\			~ Remote	site: /aq/a
A C C d	Recycle.Bin MD onfig.Msi		Last mod	ified	^ _	ewed data
Copy of Roc			1			0180218.csv
X DA 2019021	CONTRACTOR SOURCES			n 2·17	A DA 2	0181030.csv
🛃 DAD.pdf	730,428 Adob		8/5/.	Upload		ISV SV
Data Updat				Add files to	queue	
Data Updat	45,413 Micro		4/29	Open		
Selected 1 file. Tota	al size: 2,932 byte:	s		Edit		al
Server/Local file	Direc	Remote	file	Create direc Create direc Refresh	ctory ctory and enter i	it
				Delete		
Queued files	Failed transfers	Succe	essful t	Rename		

Figure 7-Screen Shot of FileZilla Upload

11) Return to IBEAM and select >PM 2.5 FRM>Site Data – Validate and Store.
Select the proper Regional Office and enter the file name you uploaded. Click
>Validate and Store. IBEAM will either tell you the files have been successfully uploaded or that there is an error, and what the errors are so you can fix them.

Figure 8-S	creen Shot	of IBEAM	Validate	and Store

ir Quality	1	✓ PM 2.5	FRM	✓ Site	DataValidate and S	tore 🗸
						1.01
Region:	Raleigh	$\sim$	File Name:	DA20201020 ×	Validate ar	id Store

12) Lab Data Review

In IBEAM, select **>Reports**, **>Ambient Monitoring and run a "Noncontinuous** Lab Data" report. Select the start sample date and the end sample date of the quarter you are reviewing. Select **>Run Report**.



	: Averages for All Sites, Single Parar : Averages for Single Site, All Param			~
Ambient Monitoring	: Averages for Single Site, Single Pa	rameter for Export		
Ambient Monitoring	: Daily Summary (1 hour averages) (	to be removed) *** RE	PAIR MODE ***	
	: Noncontinuous AQS Blanks Upload			
Ambient Monitoring	: Noncontinuous AQS Upload by Site	e2 (Corey testing)		
	: Noncontinuous Concentrations			
	: Noncontinuous E-Log All Data (to b			
	: Noncontinuous E-Log QA Report (to	o be removed) *** RE	PAIR MODE ***	
	: Noncontinuous Exceedance			
	: Noncontinuous Field Blanks			
	: Noncontinuous Field and Trip Blank			
	: Noncontinuous Includance (to be re		NODE ***	
	: Noncontinuous Invalid Site or Site I	D1 or Site ID2		
	: Noncontinuous Lab Data			
	: Noncontinuous Lab Data by Site or			
	: Noncontinuous Lead-PM10 AQS BI			
	: Noncontinuous Lead-PM10 AQS R			
	: Noncontinuous Lead-PM10 Raw PI			$\mathbf{\vee}$
Ambient Monitoring	: Noncontinuous Lead-PM10 Raw R	TI Lead Data Export (t	o be removed) *** REPAIR MODE ***	ę

13) Copy, paste and save the data from the Excel spreadsheet into the Lab Data Review tab of the template.

Figure 10-Screen Shot of the Lab Data Review tab

e		lom		Insert		age	Layou	at i	Form	nulas		ata	Revi	PW	w	Deve	loper		/ Tel	il me v	vhat y		ant to																
		+	1		¢	¥.	$f_X$	1																															
	JD R			AR5.			L SAM		AT IN		RL,M		I INCM			er_Mass		CONTA S.LAS	ENT C		F	E Cak	LDey Weill	Q I DA Da TE IO.	pr_We WS H	S ghed_n bec_PF	T Days., to_Sa noie	U Deys, to,5e mple PP	V M_T I EMP I	W_TE 1 AP_SD 1	X ABELY NDTY		Z FW_TE MP	_50	MP FV HL		de. 54	N.DHLP	
	*		*			- 1			¥1					*	*	×	×		*	12			×	*	*	×					_	* D *			×		×		*
																			C		1																		

- 14) Sort and filter the data by site. The sheet will automatically flag all of the failing criteria.
- 15) Record the results of the lab data review in the Site Validation Checklist for the site you are reviewing. Blanks that are labeled as EPA runs will be easy to spot in this spreadsheet.

Figure 11-Screen Shot of Lab Data Review

Lab Data Review	Yes	No
≤ 30 days from initial weighing date to sampling date?		
$\leq$ 30 days (or days calculated by lab) from sampling date to final weighing date?		
Arrival filter temperature less than 25° C?		
Initial weighing %RH within 5% of final weighing %RH?		

16) Field Data Review

In IBEAM select >Reports, >Ambient Monitoring and run a "Noncontinuous Site Sample Data Across All Sites (Cory, Wayne testing) report. Select >Run Report.

17) Select the pollutant (PM2.5 or PM10), the start sample date and the end sample date of the quarter you are reviewing. Select >**Run Report**.

			be removed) *** REPAIR MODE	
	g: Noncontinuous Lead-Pivi g: Noncontinuous Make-ups		(to be removed) *** REPAIR MC	
	j: Noncontinuous Marie-ups	s and volus		
	g: Noncontinuous Null Code			
		concentrations All Sites, All Da	V.F	
	j: Noncontinuous PM10 / P		y5	
		M2.5 Coarse AQS Upload (TE	STING)	
		esign Value Daily Summary		
		esign Value Historical Summa	rv.	
		esign Value Percentile Summa		
			Summary (new for WC final test)	
	: Noncontinuous Percent E			
Ambient Monitorin	: Noncontinuous Percent E	Difference Over 15%		
Ambient Monitorin	: Noncontinuous Region Q	A Report		
Ambient Monitorin	g: Noncontinuous Site Sam	ple Data		
		ple Data Across All Sites (Cor	y, Wayne testing)	
	g: Noncontinuous Site Sam			
	g: Noncontinuous Site Sam			$\checkmark$
Ambient Monitorin	g: Noncontinuous Site Sam	ple Data Errors		

Figure 12-Screen Shot of IBEAM Reports Ambient Monitoring

18) In the report, cut and paste the lab comments to the end. Delete the cassette numbers and all the associated columns. Copy, paste and save the data from the Excel spreadsheet into the Field Data Review tab of the template. You will do this for both the PM<sub>2.5</sub> and PM<sub>10</sub> data reports.

Figure 13-Screen Shot of Field Data Review Tab

		1 2	v	fx																														*
0 1 1 -	e WLG	* "-	e 1.119 -		a  AT GY ECT	1 407.5 4 4 4	/ st.ase T	н. 957 57 - 99	L Tati	- 2)	1 X	- 50	- AM	: 17.	*	8 <u>.</u>	₹ ₩2_4 -	у Рат те 199- —	у 194 (-	v rar:-	* 5 <u>-</u>	3 8-76 -	8 8738. 28 +	40 	40 10 -	и <b>с. е</b> . У <u>-</u>	м  т.,	A0 DH 1	а а ( :-	37 Vr48, -	лі ЧЦЧ _	44	۵۵ مر ـ ۲	

- 19) Sort and filter the data by site. The sheet will automatically flag all failing criteria.
- 20) Record the results of the field data review in the Site Validation Checklist for the site you are reviewing.



Field Data Review	Yes	No
Run time 0:00 to 0:00; 23 to 25 hours / 1380 to 1500 minutes? Otherwise void.		
Flow CV less than 2.0? Otherwise void.		
Average flow rate 16.7 I/min? 15.9 to 17.5 is acceptable.		
Sample volume in 23 m <sup>3</sup> to 25 m <sup>3</sup> ?		
Maximum temperature difference is < 5° C for no more than 30 minutes?		
Average temperature and relative humidity between minimun and maximum values?		
Site ID1 and site ID 2 agree?		

- 21) Electronic Logbook Review
- 22) From the Incoming file on the P drive, retrieve the appropriate e-log for the monitor being reviewed and time span.
- 23) Record the results of the electronic logbook review in the Site Validation Checklist for the site you are reviewing.

Figure 15-Screen Shot of Electronic Logbook Review

Electronic Logbook Review	Yes	No
Flow verifications and audits passed?		
Leak checks passed?		
Prescribed maintenance and cleaning performed?		2
Filter removed from sampler less than 7 days and 9 hours (177 hours) after sampling?		

24) Make comments/notes of anything you find of interest. Copy and paste text from emails, e-logs or instant messages that pertain to events affecting air monitoring at this site. Paste hyperlinks to web articles, weather data or government information that can be used for exceptional events.

- 25) Pass the Data in IBEAM
  - a) In IBEAM, go to **>PM 2.5 FRM**, **>Site Data View or Modify Records**. Select the appropriate site specific two letter code, ID2, start sample date and the end sample date of the quarter you are reviewing. Select **>Display**.
  - b) Select "Set all records to Passed QA". Fix or address all records that have issues (e.g. extreme temperature change, concentrations below  $-5 \mu g/m3$ , etc.)

21.00	±v.,		4 1	4.0	v. 1	
24:00	* 16.7	.11	24	5.1	12.1	
23:5	9 16.7	.11	24	5.1	10.6	1
0:0	0 0	0	0	0	0	
24:00	* 16.7	.11	24	5.8	12.3	
24:00	* 16.7	.11	24	.9	11.5	2
						_
	Se	t all red	cords to	Passe	d QA	7
			cords to		d QA	

Figure 16-Screen Shot of Set all records to Passed QA

26) Create Blank Files for AQS

In IBEAM, select >Reports, >Ambient Monitoring and run a "Noncontinuous AQS Blanks Upload". Select >Run Report.

Linung	17 10 0 0 0 0	Caraan Chat	- FIDEANA	Davaarta	Amphiant	Monitoring
FIGURE	I /-IBFAIVI	STPPH SHOL	OI IBEANI	RPDORS	AMMPNI	NIONIIOTINO
, ,gu, c	2, 192, 101,		0, 102, 111	neporto	,	monicoring

Ambient Monitori	ng: Averages for All Sites, Single Parameter for Export ng: Averages for Single Site, All Parameters for Export	^
	ng: Averages for Single Site, Single Parameter for Export	
	ng: Daily Summary (1 hour averages) (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous AQS biants optication and a state of the streng and the streng	
	ng: Noncontinuous Concentrations	
	ng: Noncontinuous E-Log All Data (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous E-Log QA Report (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous Exceedance	
Ambient Monitori	ng: Noncontinuous Field Blanks	
	ng: Noncontinuous Field and Trip Blanks	
	ng: Noncontinuous Includance (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous Invalid Site or Site ID1 or Site ID2	
	ng: Noncontinuous Lab Data	
	ng: Noncontinuous Lab Data by Site or Region	
	ng: Noncontinuous Lead-PM10 AQS Blanks Upload (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous Lead-PM10 AQS Raw Upload (to be removed) *** REPAIR MODE ***	
	ng: Noncontinuous Lead-PM10 Raw PM10 Data Export (to be removed) *** REPAIR MODE ***	$\sim$
Ambient Monitori	ng: Noncontinuous Lead-PM10 Raw RTI Lead Data Export (to be removed) *** REPAIR MODE ***	

a) Select a regional office, start sample date and the end sample date of the quarter you are reviewing. Select >Run Report. Open Notepad and copy the Excel data into a text file. Save the file as RB\_XXX\_XQ20XX.txt (e.g. RB\_MRO\_2Q2017). RB is for field and trip blanks.

- b) Place the file on the P drive at **P:\Ambient\PUB\RegOffices.NC\AQS\Manual Upload Files**. Do this for each regional office that has FRMs.
- 27) Create Data AQS Files

In IBEAM, select >Reports, >Ambient Monitoring and run a "Noncontinuous AQS by Site2 (Corey testing)". Select >Run Report.

Figure 18-Screen Shot of IBEAM Reports Ambient Monitoring

	ng: Averages for All Sites, S			
	ng: Averages for Single Site			$\sim$
Ambient Monitori	ng: Averages for Single Site	Single Parameter for Expor		
	ng: Daily Summary (1 hour a		* REPAIR MODE ***	
	ng: Noncontinuous AQS Bla			
	ng: Noncontinuous AQS Upl			
	ng: Noncontinuous Concenti			
	ng: Noncontinuous E-Log Al			
	ng: Noncontinuous E-Log Q		REPAIR MODE ***	
	ng: Noncontinuous Exceeda			
	ng: Noncontinuous Field Bla			
	ng: Noncontinuous Field and			
	ng: Noncontinuous Includan		AIR MODE ***	
	ng: Noncontinuous Invalid S			
	ng: Noncontinuous Lab Data			
	ng: Noncontinuous Lab Data			
			e removed) *** REPAIR MODE ***	
			removed) *** REPAIR MODE ***	
			(to be removed) *** REPAIR MODE	
Ambient Monitori	ng: Noncontinuous Lead-PN	110 Raw RTI Lead Data Exp	ort (to be removed) *** REPAIR MO	DE ***
I late la secto	7			
Help Logoff			Run Report	

- 28) Select a monitoring site, start sample date and the end sample date of the quarter you are reviewing. Select >Run Report. Open Notepad and copy the Excel data into a text file. Save the file as RD\_XX\_XQ20XX.txt (e.g. RD\_HC\_2Q2017). RD is for PM data. Do this for each site that has FRMs, placing each monitors' data in a separate file.
- 29) Do this for each site that has FRMs running as  $PM_{10}s$  as well.
- 30) Create QA Files for AQS

In the back of all FRM e-logs, there is an AQS file generator page. Copy all the Excel data strings for the quarter. Open Notepad and paste the data into a text file. Save the file as RP\_XXX\_XQ20XX.txt (e.g. RP\_MRO\_2Q2017). RP is for verification data.

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Figure 19- Screen Shot of Excel Data Strings for the Quarter

Visit Type	AQS QA Transaction Record
Monthly Verification	QA   Flow Rate Verification 0776 37 035 0004 88101 1 20180109 1 145 118 16.67 16.57
Mid-Month Verification	QA 1 Flow Rate Verification 0776 37 035 0004 88101 1 20180125 1 145 118 16.7 16.75
Monthly Verification	QA  Flow Rate Verification 0776 37 035 0004 88101 1 20180209 1 145 118 16.69 16.9
Quarterly Audit	QA  Semi-Annual Flow Rate Audit 0776 37 035 0004 88101 1 20180223 1 145 118 16.69 16.7
Monthly Verification	QA 1 Flow Rate Verification 0776 37 035 0004 88101 1 20180305 1 145 118 16.7 16.65
Mid-Month Verification	QA 1 Flow Rate Verification 0776 37 035 0004 88101 1 20180323 1 145 118 16.69 16.59
Monthly Verification	QA   Flow Rate Verification 0776 37 035 0004 88101 1 20180409 1 145 118 16.69 16.49
Mid-Month Verification	QA 1 Flow Rate Verification  0776 37 035 0004 88101 1 20180424 1 145 118 16.67 16.48
Monthly Verification	QA   Flow Rate Verification 0776 37 035 0004 88101 1 20180509 1 145 118 16.68 16.62
Quarterly Audit	QA  Semi-Annual Flow Rate Audit 0776 37 035 0004 88101 1 20180525 1 145 118 16.67 16.75
Monthly Verification	QA   Flow Rate Verification 0776 37 035 0004 88101 1 20180605 1 145 118 16.68 16.6
Mid-Month Verification	QA   Flow Rate Verification 0776 37 035 0004 88101 1 20180620 1 145 118 16.69 16.67
Monthly Verification	QA 1 Flow Rate Verification 0776 37 035 0004 88101 1 20180710 1 145 118 16.68 16.48
Mid-Month Verification	QA  Flow Rate Verification 0776 37 035 0004 88101 1 20180723 1 145 118 16.69 16.51

31) Do this for each regional office that has FRMs, placing all the data strings in the same file. Place the file on the P drive at P:\Ambient\PUB\RegOffices.NC\AQS\Manual Upload Files. Notify the Database Manager when the file is complete and ready for upload.

#### 2.63.4.5 Validation of Continuous PM BAM 1020 (PM<sub>2.5</sub>, PM<sub>10</sub> and Coarse) Data

 Make a monthly graph of the data to be validated in Envista ARM. Select the station name (e.g. Durham Armory), the monitoring parameter (in this case PM<sub>2.5</sub>), output set as graph, monthly set as the duration and then set the start date (start date will automatically be the first of the month selected). The type of report will be average, made from an hourly time base, to an hourly time base. Click OK. With a Coarse setup, like Durham Armory, you may or may not want to do this for every parameter (PM<sub>10</sub> STP, PM<sub>10-2.5</sub>). Maybe just stick with PM<sub>2.5</sub> and PM<sub>10</sub>.

Primery AQS	Output
Putose	O Tabular ( Oraph O Excel
Al v	Ownation
	O Daily O Weekly
legor -	Course Course
AI v	Ge auroy C reads
City :	Date And Time
4 0	Starl Date: 2/ 1/2020 ~
Organization	Start Time 00:00
41 V	
tation Al Statione	50p Date: 2/29/2020 ~
VARIORY	21 10m Time 23.00
03 PH/507D PH_202AR5_2 CPS BAJAAP TMP BAJAT BAJ705 BAJ	Type         Creaters         Datas         Add Features           Average Trys         - Remains         - Remains           AVRD         - Internation         - Data Raw           Trans Trys         - Accountains         - Accountains           Trans Datas         - Reveal         - Reveal Datas           Transmot         - Destroaters         - Deventery
502 1461_gas conc 5min_502	Display Montor Unit As : Default Units ~
CH	Cancel

Figure 20-Screen Shot of Envista Station Report

2) Review the graph for unusual spikes or drops in the data and readings that are missing all together. Readings that show no change over a span of time are also of importance. Make note of these irregularities for future use in validation.

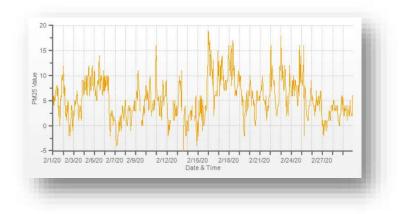


Figure 21-Screen Shot of Envidas Graph

3) Run the same report again, but this time select the PM parameter  $(PM_{2.5} \text{ or } PM_{10})$  and the BAM 1020 temperature parameter. Select Excel as the Output. Select OK.

701	Minimum	28.5	-5
702	MinDate	2/14/20 13:00	2/13/20 13:00
703	Maximum	31.4	19
704	MaxDate	2/3/20 15:00	2/16/20 00:00
705	Avg	29.398	5.2
706	Num	692	684
707	Data[%]	99.4	98.2
708	STD	0.4	3.9

Figure 22-Screen Shot of Excel Output Statistical Information

- 4) Check out the monthly synopsis at the bottom of the report for min/max readings and other statistics. Take note if the minimum reading is less than  $-5 \ \mu g/m3$  (we will run a report and highlight these later in the process). Take note of any max reading larger than  $35 \ \mu g/m3$  (if you have not already using the graph report). Take note if the min/max temp readings are outside the 28 to 32-degree window of operation (we will run a report and highlight these later in the process).
- 5) Use conditional formatting in Excel to highlight any values less than -5  $\mu$ g/m3 (if you have them) in the data set. Use conditional formatting in Excel to highlight any values not between 28 and 32 degrees (if you have them) in the data set. Save this for future validation use.

Figure 23-Screen Shot of Excel Conditional Formatting

1	A	В	C	DEFGHIJKL
1	Station: DUARMO	RY Monthly 02/20	20 Type: A	New Formatting Rule ?
3	Date & Time	BAMPTMP25	PM25	Select a Rule Tope:
4		DEGC	ug/m3(L)	Announce of the second s
5	2/1/20 00:00	29.1	6	<ul> <li>Format all cells based on their values</li> </ul>
6	2/1/20 01:00	29.1	6	<ul> <li>Format only cells that contain</li> </ul>
7	2/1/20 02:00	29.1	4	<ul> <li>Format only top or bottom ranked values.</li> </ul>
8	2/1/20 03:00	29.1	6	<ul> <li>Format only values that are above or below average</li> </ul>
9	2/1/20 04:00	29.1	5	<ul> <li>Format only unique or duplicate values</li> </ul>
0	2/1/20 05:00	29.1	5	Use a formula to determine which cells to format
1	2/1/20 06:00	29.1	7	Edit the Rule Description:
2	2/1/20 07:00	29.2	7	
3	2/1/20 08:00	29.2	8	Fgrmat only cells with:
4	2/1/20 09:00	29.2	7	Cell value 🕑 not between 🕑 28 💽 and 32
5	2/1/20 10:00	29.3	6	
6	2/1/20 11:00	29.4	8	
7	2/1/20 12:00	29.4	6	
8	2/1/20 13:00	29.4	2	Preview: AaBbCcYyZz. Eormat.
9	2/1/20 14:00	29.4	4	
0	2/1/20 15:00	29.4	2	OK Cancel
1	2/1/20 16:00	29.4	0	And
6	2/1/20 17:00	0G A	3	

- 6) Now review the E-log for the monitor and month being considered. Go to the P:\Ambient\Incoming\RegOffices.NC. In this example, we will select the Raleigh office, Logbook Reports, year 2020, BAM, Durham Armory and February. Open the E-log.
- 7) Check the dates and results of all calibrations, verifications and maintenance activities. Make notes on this. Does the E-log paint a clear picture of what happened during the month? If not, contact the operator for clarification. Here are some important things to look out for during your E-log review:
  - a) If a calibration was done for any reason, did a verification precede it?
  - b) When was the last calibration performed?
  - c) When was the last background test?
  - d) Is there a verification for this month? Are there two? Three?
  - e) Is this a month in which an audit should be performed (usually the month in the middle of each quarter: Feb, May, Aug, Nov)? Were different devices used for this audit and not the same devices used to calibrate or verify?
  - f) Was quarterly maintenance performed (usually at the same time as the audit, but not always)?
  - g) Was monthly maintenance performed?
  - h) Was bi-monthly maintenance performed?
  - i) Did the leak checks pass?
  - j) Look behind a month and forward into the next month in the E-log (if available). Do you see any glaring problems that may invalidate data back into the month you are reviewing? Are there any problems in last month's data that need to be coded forward into the month you are reviewing?
  - k) If a monitor was swapped out, was an ending verification done prior to the replacement?
  - 1) If a monitor up and died, were the data voided back to the last good verification?
- 8) Now back to Envista ARM. Select the Edit tab, then Edit Table. Choose your station, parameter(s), make the output tabular, duration will be monthly (date and time will self-

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correct for the month) and report type will be standard with the time base of one hour. Click OK.

Primary AQS	Output
Purpose :	Tabular O Graph
All 🗸 🗸	Duration
Region :	O Daily O Weekly
All ~	Monthly O Period
City :	
All v	Date And Time
Organization :	Start Date : 2/ 1/2020 ~
↓ All	Start Time : 00:00
Station :	Stop Date 2/29/2020 ~
DUARMORY V	An and a second s
All 🛛 On Monitors 🤱	Stop Time 23:00
CPS A	Туре
BAMAP	View Style
BAMAT	Standard ~
BAM10	Time Base :
BAMPTMP25 BAMTMP10	1 Hour 🗸
PM25	Use EPA Statuses
_ S02 🗸	

Figure 24-Screen Shot of Envista Edit Table Window

9) If the resulting report is green (see below) you are good to go. If it is light yellow, the second level review has not been performed. If it is brown, you have already signed off on this data.

Figure 25-Screen	Shot of Envista	Green Edit Report
------------------	-----------------	-------------------

Date & Time	PM25	Status
	[ug/m3(L)]	
2/1/20 00:00	8.0	- Ok
2/1/20 01:00	6.0	- Ok
2/1/20 02:00	3.0	- Ok
2/1/20 03:00	1.0	- Ok
2/1/20 04:00	1.0	- Ok
0 14 10 0 0 T 0 0		-

- 10) Another way to find the reviewing information is to use the Validation Settings option under the Edit tab, or, under the Reports tab, use the Validation report.
- 11) Now is when we bring all the reports together. Go through and deal with anything you found while performing the first step of graphing the data (high, low, stuck or missing). Apply codes accordingly to your review and inquiry.
- 12) For an example, let's use a very high reading, surrounded by low readings (a large peak on the graph). If you and the operator have done your due diligence, and the reading is deemed valid, you will need to add some flag codes. If the reading is not valid, you

will need to use a void code. In this example, we will flag it as valid. Select the value and right click. Select Enter/Change Comment Explanation/Comment.

2/10/20 09:00	7.0	- Ok	
2/10/20 10:00	9.0	- Ok	
2/10/20 11:00	13.0	- Ok	
2/10/20 12:00	63.0	Enter/Change Edit Info	
2/10/20 13:00	13.0	Open Edit Block	
2/10/20 14:00	3.0	Enter/Change Explanation/Comment	
2/10/20 15:00	5.0	Save Columns Size	
2/10/20 16:00	2.0	Clear Explanations/Comments	
2/10/20 17:00	4.0	Hide Status Columns	
2/10/20 18:00	4.0	- Ok	
2/10/20 10:00	20	- OK	

Figure 26- Screen Shot of Envista Green Edit Report with an Outlier

13) Next, we see that the operator or level two reviewer has inserted a comment stating that the reading was reported in the monitor's downloaded data as the same value. Be careful to not overwrite this comment.

Figure 27- Screen Shot of Envista Green Edit Report Comments

PLANED 00.00	A.A.				
2/10/20 06:00	5.0	- Ok	Enter Explanation/Comment		×
2/10/20 07:00	5.0	- Ok			
2/10/20 08:00	5.0	- Ok	Explanation		Additional Explanations (Max 9): 0
2/10/20 09:00	7.0	- Ok	(None)	*	
2/10/20 10:00	9.0	- Ok	Comment		10. 1-Point QC check exceeds, evidence data is will TV. Data reviewed and validated ( ALL )
2/10/20 11:00	13.0	- Ok	download • €3		Coperational Deviden (ALL)     Arebisser (ALL)     Arebisser (ALL)     Coperational Deviden (ALL)     Coperation (ALL)     Coperation (ALL)     Coperation (ALL)     Coperation (ALL)
2/10/20 12:00	63.0	- Ok			
2/10/20 13:00	13.0	- Ok			
2/10/20 14:00	3.0	- Ok			
2/10/20 15:00	5.0	- Ok			9 Negative value detected - zero reported (ALL)
2/10/20 16:00	2.0	- Ok			CB. Values have been Slavk Corrected (ALL.)
2/10/20 17:00	4.0	- Ok	Add / Change	Cancel	CL. Surrogate Recoveries Outside Control Lints ( , V
2/10/20 18:00	4.0	-Ok		The Charles of Charles of	
000000000	0.0	01.			

14) First, from the drop-down menu, select a flag of "5" to mark the value as an outlier.

Figure 28- Screen Shot of Envista Green Edit Report Explanation

2/10/20 08:00		5.0	- Ok	Explanation	Additional Explanations (Max 9)
2/10/20 09:00		7.0	- Ok	(10)me) V	1 Devater from a CFE Ortical Onten Requirement
2/10/20 10:00		9.0	- Ok	(Nana) A 1. Deviation Roma CFR Critical Criteria Resultament	10 12 1244 OC stresh exceeds, enderce deta is will TV Data reviewed and validated (ALL.)
2/10/20 11:00		13.0	- OK	1C. 1-Point GC check exceeds, writtence data is vit	2. Operational Deviation (ALL.)
2/10/20 12:00		63.0	-Ok	1V. Deta reviewed and validated ( ALL ) 2. Operational Deviation ( ALL )	S Field basin (ALL ) = Last basin (ALL )
2/10/20 13:00		13.0	- Ok	3 Field Issue ( ALL )	5 Outler (ALL )
2/10/20 14:00		3.0	-Ok	4 Lab Issue ( ALL ) 5 Octory ( ALL )	6 GAPP Issue (ALL)     7 Berry Lewest Califration Level (ALL)
2/10/20 15:00		5.0	OK	6. QAPP Issue ( ALL ) 7. Below Lowest Calibration Level ( ALL )	D. Negative value datacted - zero reported (ALL )
2/10/20 16:00	1	2.0	- OK	9 Negetive value detected - zero reported ( ALL )	CEL Values have been them Connected (ALL.) CEL Creat Canader Residue (ALL.)
2/10/20 17:00		40	- Ok	CB Values have been Blank Contacted ( ALL ) CC Cean Canater Residue ( ALL )	C. Serruptin Recoveries Collectin Control Linds (1997)
2/10/20 18:00	1	4.0	- Ok	CL. Surregare Recoveries Cutaite Control Links ( EH Estimated Exceeds Loper Rance ( ALL )	
2/10/20 19:00		3.0	Ok	FB. Field Blank Value Above Acceptable Linit ( AL	
2/10/20 20:00		1.0	- Ok	HT Sample pick-up hold time exceeded (ALL) H, Allycar Dust (ALL)	
2/10/20 21 00		1.0	- Ok	B. Asten Duel ( ALL ) C. Chem. Solle. #DUIST Accidents ( ALL )	
2/10/20 22:00	1	0.0	- OK	C Cestup After a Major Usaster ( ALL )	
2/10/20 23:00		-1.0	- Ok	E Denteilton (ALL) F Fire - Canadian (ALL)	
2/11/20 00:00		-1.0	-OK	D. Fre - Mexico/Central Americe ( ALL ) H. Frevenin ( ALL )	
2/11/20 01:00		1.0	- Ok	8. High Pollen Court ( ALL )	
2/11/20 02 00	1	-1.0	- Ok	U. High WHOS (ALL.) K. Infrequent Large Datherings (ALL.)	
a seve	900	9 unt Al	Show Edit who	Show EL. Other (ALL) M. Prescribed Fre (ALL)	

15) Second, from the additional explanation window, apply the "V" flag for validated value. This helps others know that due diligence has been used in looking into the causes or lack thereof. The value will turn blue to show that comments or flags have been applied. This value is good to go.

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2/10/20 00:00	0.0	- UK		
2/10/20 06:00	5.0	- Ok	Enter Explanation/Comment	×
2/10/20 07:00	5.0	- Ok		
2/10/20 08:00	5.0	- Ok	Explanation	Additional Explanations (Max 9):
2/10/20 09:00	7.0	- Ok	5. Outlier (ALL.) ~	RP. Structural Fire (ALL )
2/10/20 10:00	9.0	- Ok	Comment	RQ. Terrorist Act (ALL) RR. Unique Traffic Disruption (ALL)
2/10/20 11:00	13.0	- Ok	download = 63	RS. Volcanic Eruptions (ALL )
2/10/20 12:00	63.0	- Ok		RT. Wildfire-U. S. (ALL) SQ. Values Between SQL and MDL (ALL)
2/10/20 13:00	13.0	- Ok		SS. Value substituted from secondary monitor (AL
2/10/20 14:00	3.0	- Ok		SX. Does Not Meet Siting Criteria (ALL) TB. Trip Blank Value Above Acceptable Limit (ALL
2/10/20 15:00	5.0	- Ok		TT. Transport Temperaure is Out of Specs. (ALL )
2/10/20 16:00	2.0	- Ok		V. Validated Value (ALL.) VB. Value below normal; no reason to invalidate (
2/10/20 17:00	4.0	- Ok	Add / Change Cancel	W. Flow Rate Average out of Spec. (ALL )
2/10/20 18:00	4.0	- Ok		

Figure 29- Screen Shot of Envista Green Edit Report Explanation with additional Explanation Window

16) Now we use the less than -5 μg/m3 report that we made in the second step. Go through the edit table and apply the flag "MD" (value being less than the minimum detection limit) to all values -6 to -10. Any values less than -10 must be voided with null code "BR –Sample Value Below Acceptable Range."

2/5/20 08:00	9.0	- Ok	Testa da	Additional Explanations (Max 9) : 0
2/5/20 09:00	3.0	- Ok	Explanation (None)	1. Deviation from a CFR Critical Criteria Requiremer
2/5/20 10:00	2.0	- Ok	E. Demolition (ALL)	1C. 1-Point QC check exceeds, evidence data is vi
2/5/20 11:00	5.0	- Ok	IF. Fire - Canadian ( ALL ) IG. Fire - Mexico/Central America ( ALL )	IV. Data reviewed and validated (ALL)     2 Operational Deviation (ALL)
2/5/20 12:00	-6.0	- Ok	IH. Fireworks (ALL) II. High Pollen Count (ALL)	3. Field Issue (ALL)
2/5/20 13:00	4.0	- Ok	U. High Winds ( ALL )	5. Outlier (ALL)
2/5/20 14:00	2.0	- Ok	IK. Infrequent Large Gatherings (ALL) IL. Other (ALL)	6. QAPP Issue (ALL) 7. Below Lowest Calibration Level (ALL)
2/5/20 15:00	-2.0	- Ok	IM. Prescribed Fire (ALL) IN. Seismic Activity (ALL)	9. Negative value detected - zero reported (ALL)
2/5/20 16:00	-1.0	- Ok	IO. Stratospheric Ozone Intrusion ( ALL )	CB. Values have been Blank Corrected (ALL) CC. Clean Canister Residue (ALL)
2/5/20 17:00	3.0	- Ok	IP. Structural Fire (ALL) IQ. Terrorist Act (ALL)	CL. Surrogate Recoveries Outside Control Limits (
2/5/20 18:00	-1.0	- Ok	IR. Unique Traffic Disruption (ALL)	
2/5/20 19:00	3.0	- Ok	IT. Wildfire-U. S. (ALL)	
2/5/20 20:00	3.0	- Ok	IU. Wildland Fire Use Fire-U. S. (ALL) LB. Lab blank value above acceptable limit (ALL)	
2/5/20 21:00	1.0	- Ök	LJ. Analyte ID Acceptable; Reported Value Is Estim LK. Analyte ID: Reported Value May Be Biased Hig	
2/5/20 22:00	2.0	- Ok	LL. Analyte ID; Reported Value May Be Biased Lov	
2/5/20 23:00	3.0	- Ok	MD. Value less than MDL (ALL) MS. Value reported is 1/2 MDL substituted. (ALL)	
2/6/20 00:00	1.0	- Ok	MX. Matrix Effect ( ALL ) ND. No Value Detected ( ALL )	
2/6/20 01:00	3.0	- Ok	NS. Influenced by nearby source ( ALL )	
2/6/20 02:00	1.0	- Ok	QX. Does not meet QC criteria (ALL) RA. African Dust (ALL)	
- Save	9 Undo Al	Show Edit Info	Show E RB. Asian Dust ( ALL ) RC. Chem. Spills & Industrial Accidents ( ALL )	

Figure 30-Screen Shot of Envista Green Edit Report Explanation with MD Flag

17) Now we use the 28 to 32-degree report that we made in the second step. Go through the edit table and apply the flag "6" (QAPP issue) to all PM values that have an hourly temperature not within 28 to 32 degrees. Any values that do not have a corresponding hourly temperature should be voided with "AI – Insufficient Data".

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2/1/20 02:00	4.0	- OK		
2/1/20 03:00	6.0	- Ok	Enter Explanation/Comment	>
2/1/20 04:00	5.0	- Ok		
2/1/20 05:00	5.0	- Ok	Explanation Additional Explanations (Max 9) 0	
2/1/20 06:00	7.0	- Ok	(None) 1. Deviation from a CFR Critical Criteri	
2/1/20 07:00	7.0	- Ok	(None)  1 Deviation from a CEP Critical Criteria Dequirement  1 Deviation from a CEP Critical Criteria Dequirement  1 U. 1-Point QC check exceeds, evided  1 V. Data reviewed and validated (AL	
2/1/20 08:00	8.0	- Ok	1C. 1-Point QC check exceeds, evidence data is v: 2. Operational Deviation (ALL )	- /
2/1/20 09:00	7.0	- Ok	1V. Data reviewed and validated (ALL) 2. Operational Deviation (ALL) 4. Lab Issue (ALL)	
2/1/20 10:00	6.0	- Ok	3. Field Issue (ALL) 5. Outlier (ALL)	
2/1/20 11:00	8.0	- Ok	4. Lab issue (ALL) 5. Outlier (ALL) 6. QAPP Issue (ALL) 7. Below Lowest Calibration Level (A	LL)
2/1/20 12:00	6.0	- Ok	6. QAPP Issue ( ALL ) 9. Negative value detected - zero repr 7. Below Lowest Calibration Level ( ALL ) CB. Values have been Black Corrected	
2/1/20 13:00	2.0	- Ok	9. Negative value detected - zero reported (ALL)	(ALL)
2/1/20 14:00	4.0	- Ok	CB. Values have been Blank Corrected (ALL) CL. Surrogate Recoveries Outside Co CC. Clean Canister Residue (ALL)	ntrol Limits ( / 🗸
2/1/20 15:00	2.0	- Ok	CL. Surrogate Recoveries Outside Control Limits (     EH. Estimated; Exceeds Upper Range ( ALL )	_
2/1/20 16:00	0.0	Ok	En. Estimated, Exceeds Opper Range ( ALL ) ER. Eield Black Value Above Accentable Limit ( A)	

Figure 31- Screen Shot of Envista Green Edit Report Explanation with 6 Flag

18) Now, using your notes from the E-log review, apply codes to the hours in the edit table where calibrations, maintenance, verifications, zero backgrounds and other events took place. Void the appropriate number of hours to ensure the BAM has stabilized and is once again collecting valid data. If the operator performed more than one activity and voided more than one hour, be sure the operator used different null codes for the two hours so as to "tell the story" of what happened at the site. Review the list in step 6 for anything you may have missed.

2/7/20 08:00	1.0	- Ok		
2/7/20 09:00	-1.0	- Ok		
2/7/20 10:00	3.0	AX - Precision		
2/7/20 11:00	-15.0	BA - Maintain		
2/7/20 12:00	5.0	- Ok		
2/7/20 13:00	-1.0	- Ok	~	
2/7/20 14:00	2.0	- Ok		

Figure 32- Screen Shot of Envista Green Edit Report "Telling the Story"

- 19) Continue the same process above for the PM<sub>10</sub> parameter of the Coarse system. Keep in mind that the same codes will be used for PM<sub>10</sub> STP as PM<sub>10</sub> at local conditions. Also, the PM<sub>10-2.5</sub> (Coarse) reading will be influenced by the validity of <u>both</u> the PM<sub>2.5</sub> and PM<sub>10</sub> monitors. You must have valid readings for both units for there to be a valid Coarse reading (temperatures included).
- 20) Once you are happy with your review, click the save icon. Now go to Validation Settings in the Edit tab. Select the time range you would like to validate (usually a whole month at a time). Select the parameter(s) at a site. Click Add. You are done.

*Figure 33-Screen Shot of Envidas Validation Settings* 

station's Monitor	s Last Validations				Date And Time		
Current User Na	me : Paul Chappin	Highes	t Edit Level : Final		Start Date : 2/ 1/2	2020 ~	
1 * S	tation	Monitor	Start DateTime	Stop DateTime 🔺	Start Time : 00	):00	
E BAY	VIEW						
E BC	DED				Stop Date : 2/29/2	2020 ~	
BEAU	IFORT				Stop Date . 2/23/2	.020 0	
E BET	HANY				Stop Time : 23	3:59	
± zBLA	CKSTN						
BNTC	CREEK				NEWHANO		^
BRY	SON						^
BUSH	IYFRK				PURCHASE		
E BUT	INER				SEMORA DRR		
CAN	IDOR				SKYLAND DR		
E CAN	DOR1				SPUCE PINE		
E CAS	TLE H				1022BAMF	Ł	-
E CHER	RRYGR				- PM25		
E CLEM	MONS						
E COM	VEETA				TAYLORSV		
E CRAM	NBERY				TRIPLOAK		
	hiles				TYLRV13		¥
<				>	Add Ca	ancel	

#### 2.63.4.6 Validation of BAM 1022 Data

1) Make a monthly graph of the data to be validated in Envista ARM. Select the station name (e.g. Spruce Pine), the monitoring parameter (in this case PM<sub>2.5</sub>), output set as graph, monthly set as the duration and then set the start date (start date will automatically be the first of the month selected). The type of report will be average, made from an hourly time base, to an hourly time base. Click OK.

Primary AQS	Output
Purpose :	C mar C mar C mar
Al v	
Region :	O Daily O Weekly
Al v	Monthly      Period
City :	Date And Time
Al v	
Organization :	
AI v	Start Time : 00:00
Station : 🗌 All Stations	Stop Date 2/29/2020 ~
	Stop Time : 23:00
PMD5	Average Type
	AVG v Partial
	From Time Base
	1 Hour Accumulate
	Time Base : Round Data
	1 Hour Summary
	Seperate Monitors
	Display Montor Unit As : Default Units ~
	- F
08	
	Cancel

Figure 34- Screen Shot of Envista Station Report

 Review the graph for unusual spikes or drops in the data and readings that are missing all together. Readings that show no change over a span of time are also of importance. Make note of these irregularities for future use in validation.





3) Run the same report again, but this time select Excel as the Output. Select OK. Check out the monthly synopsis at the bottom of the report for min/max readings and other statistics. Take note if the minimum reading is less than  $-5 \ \mu g/m3$  (we will run a report and highlight these later in the process). Take note of any max reading larger than 35  $\ \mu g/m3$  (if you have not already using the graph report).



0.00	LILSTLU 15.00	9
697	2/29/20 20:00	2
698	2/29/20 21:00	6
699	2/29/20 22:00	4
700	2/29/20 23:00	5
701	Minimum	-7
702	MinDate	2/15/20 09:00
703	Maximum	23
704	MaxDate	2/10/20 12:00
705	Avg	4.5
706	Num	637
707	Data[%]	91.5
708	STD	4.4

4) Use conditional formatting in Excel to highlight any values less than -5  $\mu$ g/m3 (if you have them) in the data set. Save this for future validation use.

Figure 37-Screen Shot of Excel Conditional Formatting

Date & Time	FM25	participant in the second				-		1
	1g/m3(L)	New Formatting Ru	e			- 2	7 ×	
2/1/20 00:00	8	Select a Rule Type:						10
2/1/20 01:00	6							6E
2/1/20 02:00	3	<ul> <li>Format all cells ba</li> </ul>						-IE
2/1/20 03:00	1	· Format only calls (						48
2/1/20 04:00	- 1. · · · ·	+ Format only top or						10
2/1/20 05:00	7	+ Tonnat only values		elcia everage				18
2/1/20 06:00	4	<ul> <li>Format only unique</li> </ul>						10
2/1/20 07:00	-1	<ul> <li>Use a formula to d</li> </ul>	letermine which calls	to format				10
2/1/20 08:00	3	Edit the Role Description						1
2/1/20 09:00	ĕ							-1
2/1/20 10:00	4	Format only cells a	ith:					10
2/1/20 11:00	6	Cell Value (6	less than	(4)	6		14	11
2/1/20 12:00	5							10
2/1/20 13:00	3							18
2/1/20 14:00	6							- 10
2/1/20 15:00	6	Preview:	ALCONCUTATION.		format.			18
2/1/20 16:00	5							11
2/1/20 17:00	3					DK	Cancel	18
2/1/20 18:00	2	1.11						51
	1000						_	-

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Figure 38-Screen Shot of Highlighted Data less than -5ug/m3

1	A	B	
03	2/5/20 02:00	8	
04	2/5/20 03:00	9	
05	2/5/20 04:00	10	
06	2/5/20 05:00	11	
07	2/5/20 06:00	14	
08	2/5/20 07:00	11	
09	2/5/20 08:00	9	
10	2/5/20 09:00	3	
11	2/5/20 10:00	2	
12	2/5/20 11:00	5	
13	2/5/20 12:00	-6	
14	2/5/20 13:00	4	
15	2/5/20 14:00	2	
	A 15 100 15 00	~	

- 5) Now review the E-log for the monitor and month being considered. Go to the P:\Ambient\Incoming\RegOffices.NC. In this example we will select the Asheville office, Logbook Reports, year 2020, BAM, Spruce Pine and February. Open the E-log.
- 6) Check the dates and results of all calibrations, verifications and maintenance activities. Make notes on this. Does the E-log paint a clear picture of what happened during the month? If not, contact the operator for clarification. Here are some important things to look out for during your E-log review:
  - a) If a calibration was done for any reason, did a verification precede it?
  - b) When was the last calibration performed?
  - c) When was the last background test?
  - d) Is there a verification for this month? Are there two? Three?
  - e) Is this a month in which an audit should be performed (usually the month in the middle of each quarter: Feb, May, Aug, Nov)? Were different devices used for this audit and not the same devices used to calibrate or verify?
  - f) Was quarterly maintenance performed (usually at the same time as the audit, but not always)?
  - g) Was monthly maintenance performed?
  - h) Was bi-monthly maintenance performed?
  - i) Did the leak checks pass?
  - j) Look behind a month and forward into the next month in the E-log (if available). Do you see any glaring problems that may invalidate data back into the month you are reviewing? Are there any problems in last month's data that need to be coded forward into the month you are reviewing?
  - k) If a monitor was swapped out, was an ending verification done prior to the replacement?
  - 1) If a monitor up and died, were the data voided back to the last good verification?

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Now back to Envista ARM. Select the Edit tab, then Edit Table. Choose your station, parameter, make the output tabular, duration will be monthly (date and time will self-correct for the month) and report type will be standard with the time base of one hour. Click OK.

Eiguro	39-Screen	Chot	of	Envicto	Edit	Tabla	Window
iyure	J <i>J</i> -JCIEEII	Shot	ΟJ	LIIVISLU	Lun	TUDIE	vviiluovv

Primary AQS	Output
Purpose :	🔿 Tabular 💿 Graph
All v	Duration
Region :	O Daily O Weekly
All 🗸 🗸	Monthly O Period
City :	Date And Time
All 🗸	Start Date : 2/ 1/2020 V
Organization :	Start Time : 00:00
All 🗸	Start lime : 00:00
Station :	Stop Date : 2/29/2020 ~
SPUCE PINE V	Stop Time : 23:00
All 🔽 On Monitors 🍇	Туре
/ Pm25	View Style
	Standard V
	Time Base :
	1 Hour 🗸 🗸
	Use EPA Statuses

7) If the resulting report is green (see below) you are good to go. If it is light yellow, the second level review has not been performed. If it is brown, you have already signed off on this data.

Date & Time	PM25	Status
	[ug/m3(L)]	
2/1/20 00:00	8.0	- Ok
2/1/20 01:00	6.0	- Ok
2/1/20 02:00	3.0	- Ok
2/1/20 03:00	1.0	- Ok
2/1/20 04:00	1.0	- Ok
	~ ~	~

Figure 40-Screen Shot of Envista Green Edit Report

Another way to find the reviewing information is to use the Validation Settings option under the Edit tab, or, under the Reports tab, use the Validation report.

- 8) Now is when we bring all the reports together. Go through and deal with anything you found while performing the first step of graphing the data (high, low, stuck or missing). Apply codes accordingly to your review and inquiry.
- 9) For an example, let's use a very high reading, surrounded by low readings (a large peak on the graph). If you and the operator have done your due diligence, and the reading is deemed valid, you will need to add some flag codes. If the reading is not valid, you will need to use a void code. In this example, we will flag it as valid. Select the value and right click. Select Enter/Change Comment Explanation/Comment.

2/10/20 09:00	7.0	- Ok
2/10/20 10:00	9.0	- Ok
2/10/20 11:00	13.0	- Ok
2/10/20 12:00	63.0	Enter/Change Edit Info
2/10/20 13:00	13.0	Open Edit Block
2/10/20 14:00	3.0	Enter/Change Explanation/Comment
2/10/20 15:00	5.0	Save Columns Size
2/10/20 16:00	2.0	Clear Explanations/Comments
2/10/20 17:00	4.0	Hide Status Columns
2/10/20 18:00	4.0	- Ok
2/10/20 10:00	3.0	- Ok

Figure 41- Screen Shot of Envista Green Edit Report with an Outlier

10) Next, we see that the operator or level two reviewer has inserted a comment stating that the reading was reported in the monitor's downloaded data as the same value. Be careful to not overwrite this comment.

2/10/20 06:00	5.0	- Ok		
			Enter Explanation/Comment	×
2/10/20 07:00	5.0	- Ok		here and the second second second
2/10/20 08:00	5.0	- Ok	Explanation	Additional Explanations (Max 9) : 0
2/10/20 09:00	7.0	- Ok	(None) ~	1. Deviation from a CFR Critical Criteria Requiremer 🔥
2/10/20 10:00	9.0	- Ok	Comment	1C. 1-Point QC check exceeds, evidence data s vi     1V. Data reviewed and validated (ALL)
2/10/20 11:00	13.0	- Ok	download = 63	2. Operational Deviation (ALL.)
2/10/20 12:00	63.0	- Ok		3. Field Issue (ALL) 4. Lab Issue (ALL)
2/10/20 13:00	13.0	- Ok		5. Outler (ALL.)
2/10/20 14:00	3.0	- Ok		6. QAPP Issue (ALL.) 7. Below Lowest Calibration Level (ALL.)
2/10/20 15:00	5.0	- Ok		9. Negative value detected - zero reported (ALL.)
2/10/20 16:00	2.0	- Ok		CB. Values have been Blank Corrected (ALL) CC. Clean Canister Residue (ALL)
2/10/20 17:00	4.0	- Ok	Add / Change Cancel	CL. Surrogate Recoveries Outside Control Limita (, 👻
2/10/20 18:00	4.0	- Ok		
00.01 0001	2.0	Oli		

11) First, from the drop-down menu, select a flag of "5" to mark the value as an outlier.

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2/10/20 05:00	6.0	- Ok		
2/10/20 06:00	5.0	- Ok	Enter Explanation/Comment	×
2/10/20 07:00	5.0	- Ok		
2/10/20 08:00	5.0	- Ok	Explanation	Additional Explanations (Max 9) :
2/10/20 09:00	7.0	- Ok	(None) ~	1. Deviation from a CFR Critical Criteria Requiremer
2/10/20 10:00	9.0	- Ok	(None) 1. Deviation from a CFR Critical Criteria Requiremen	1C. 1-Point QC check exceeds, evidence data is vi     1V. Data reviewed and validated (ALL)
2/10/20 11:00	13.0	- Ok	1C. 1-Point QC check exceeds, evidence data is va	2. Operational Deviation (ALL)
2/10/20 12:00	63.0	- Ok	1V. Data reviewed and validated (ALL) 2. Operational Deviation (ALL)	3. Field Issue (ALL) 4. Lab Issue (ALL)
2/10/20 13:00	13.0	- Ok	3. Field Issue ( ALL )	5. Outlier (ALL)
2/10/20 14:00	3.0	- Ok	4. Lab Issue ( ALL ) 5. Outlier ( ALL )	6. CAPP Issue (ALL ) 7. Below Lowest Calibration Level (ALL )
2/10/20 15:00	5.0	- Ok	6. QAPP Issue ( ALL ) 7. Below Lowest Calibration Level ( ALL )	9. Negative value detected - zero reported (ALL)     CB. Values have been Blank Corrected (ALL)
2/10/20 16:00	2.0	- Ok	9. Negative value detected - zero reported ( ALL )	CB. Values have been blank corrected (ALL)
2/10/20 17:00	4.0	- Ok	CB. Values have been Blank Corrected ( ALL ) CC. Clean Canister Residue ( ALL )	CL. Surrogate Recoveries Outside Control Limits (, 💙
2/10/20 18:00	4.0	- Ok	CL. Surrogate Recoveries Outside Control Limits (. EH. Estimated; Exceeds Upper Range ( ALL )	
2/10/20 19:00	3.0	- Ok	FB. Field Blank Value Above Acceptable Limit ( AL	
2/10/20 20:00	1.0	- Ok	HT. Sample pick-up hold time exceeded (ALL) IA. African Dust (ALL)	
2/10/20 21:00	1.0	- Ok	B. Asian Dust ( ALL ) IC. Chem. Spills :INDUST Accidents ( ALL )	
2/10/20 22:00	0.0	- Ok	D. Cleanup After a Major Disaster ( ALL )	
2/10/20 23:00	-1.0	- Ok	E. Demoition ( ALL ) F. Fire - Canadian ( ALL )	
2/11/20 00:00	-1.0	- Ok	IG. Fire - Mexico/Central America (ALL) H. Fireworks (ALL)	
2/11/20 01:00	1.0	- Ok	I. High Pollen Count ( ALL )	
2/11/20 02:00	-1.0	- Ok	U. High Winds ( ALL ) K. Infrequent Large Gatherings ( ALL )	
Save	9 Undo 9 Undo All	Show Edit Info	Show EL Other (ALL)	

Figure 43- Screen Shot of Envista Green Edit Report Explanation with additional Explanation Window

12) Second, from the additional explanation window, apply the "V" flag for validated value. This helps others know that due diligence has been used in looking into the causes or lack thereof. The value will turn blue to show that comments or flags have been applied. This value is good to go.

Figure 44- Screen Shot of Envista Green Edit Report Explanation with additional Explanation Window

2/10/20 05:00	0.0	- OK	
2/10/20 06:00	5.0	- Ok	Enter Explanation/Comment ×
2/10/20 07:00	5.0	- Ok	
2/10/20 08:00	5.0	- Ok	Explanation Additional Explanations (Max 9) : 1
2/10/20 09:00	7.0	- Ok	5. Outlier (ALL.)
2/10/20 10:00	9.0	- Ok	Comment RQ. Terrorist Act (ALL )
2/10/20 11:00	13.0	- Ok	download = 63 RS. Volcanic Eruptions (ALL )
2/10/20 12:00	63.0	- Ok	RT. Wildfire-U. S. (ALL)
2/10/20 13:00	13.0	- Ok	SS. Value substituted from secondary monitor (AL
2/10/20 14:00	3.0	- Ok	SX. Does Not Meet Siting Criteria (ALL)
2/10/20 15:00	5.0	- Ok	TT. Transport Temperaure is Out of Specs. (ALL )
2/10/20 16:00	2.0	- Ok	V. Validated Value (ALL.) VB. Value below normal; no reason to invalidate (
2/10/20 17:00	4.0	- Ok	Add / Change Cancel W. Flow Rate Average out of Spec. (ALL )
2/10/20 18:00	4.0	- Ok	

13) Now we use the less than  $-5 \ \mu g/m^3$  report that we made in the second step. Go through the edit table and apply the flag "MD" (value being less than the minimum detection limit) to all values -6 to -10. Any values less than -10 must be voided with null code "BR –Sample Value Below Acceptable Range".

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2/5/20 08:00	9.0	- Ok	Explanation	Additional Explanations (Max 9) : 0
2/5/20 09:00	3.0	- Ok	(None) ~	1. Deviation from a CFR Critical Criteria Requiremer
2/5/20 10:00	2.0	- Ok	IE. Demolition ( ALL )	1C. 1-Point QC check exceeds, evidence data is vi     1V. Data reviewed and validated (ALL)
2/5/20 11:00	5.0	- Ok	IF. Fire - Canadian (ALL) IG. Fire - Mexico/Central America (ALL)	2. Operational Deviation (ALL)
2/5/20 12:00	-6.0	- Ok	IH. Fireworks (ALL) II. High Pollen Count (ALL)	3. Field Issue (ALL) 4. Lab Issue (ALL)
2/5/20 13:00	4.0	- Ok	U. High Winds (ALL)	5. Outlier (ALL)
2/5/20 14:00	2.0	- Ok	K. Infrequent Large Gatherings (ALL)	6. QAPP Issue (ALL.) 7. Below Lowest Calibration Level (ALL.)
2/5/20 15:00	-2.0	- Ok	IM. Prescribed Fire (ALL) IN. Seismic Activity (ALL)	9. Negative value detected - zero reported (ALL)
2/5/20 16:00	-1.0	- Ok	IO. Stratospheric Ozone Intrusion (ALL)	CB. Values have been Blank Corrected (ALL)
2/5/20 17:00	3.0	- Ok	IP. Structural Fire (ALL) IQ. Terrorist Act (ALL)	CL. Surrogate Recoveries Outside Control Limits (
2/5/20 18:00	-1.0	- Ok	R. Unique Traffic Disruption (ALL) IS. Volcanic Eruptions (ALL)	
2/5/20 19:00	3.0	- Ok	IT. Wildfire-U. S. (ALL)	
2/5/20 20:00	3.0	- Ok	IU. Wildland Fire Use Fire-U. S. (ALL) LB. Lab blank value above acceptable limit (ALL)	
2/5/20 21:00	1.0	- Ok	LJ. Analyte ID Acceptable; Reported Value Is Estim	
2/5/20 22:00	2.0	- Ok	LK. Analyte ID; Reported Value May Be Biased Hig LL. Analyte ID; Reported Value May Be Biased Lov	
2/5/20 23:00	3.0	- Ok	MD. Value less than MDL (ALL.) MS. Value reported is 1/2 MDL substituted. (ALL.)	
2/6/20 00:00	1.0	- Ok	MX. Matrix Effect ( ALL )	
2/6/20 01:00	3.0	- Ok	ND. No Value Detected ( ALL ) NS. Influenced by nearby source ( ALL )	
2/6/20 02:00	1.0	- Ok	QX. Does not meet QC criteria (ALL) RA. African Dust (ALL)	
Save 9	Undo Undo All		Show E RB. Asian Dust ( ALL ) RC. Chem. Spills & Industrial Accidents ( ALL ) Show Status Colors	

Figure 45-Screen Shot of Envista Green Edit Report Explanation with MD Flag

14) Now, using your notes from the E-log review, apply codes to the hours in the edit table where calibrations, maintenance, verifications, zero backgrounds and other events took place. Void the appropriate number of hours to ensure the BAM has stabilized and is once again collecting valid data. If the operator performed more than one activity and voided more than one hour, ensure the operator used different null codes for the two hours so as to "tell the story" of what happened at the site. Review the list in step 6 for anything you may have missed.

2/7/20 08:00	1.0	- Ok
2/7/20 09:00	-1.0	- Ok
2/7/20 10:00	3.0	AX - Precision
2/7/20 11:00	-15.0	BA - Maintain
2/7/20 12:00	5.0	- Ok
2/7/20 13:00	-1.0	- Ok 😽
2/7/20 14:00	2.0	- Ok

Figure 46-Screen Shot of Envista Green Edit Report "Telling the Story"

15) Once you are happy with your review, click the save icon. Now go to Validation Settings in the Edit tab. Select the time range you would like to validate (usually a whole month at a time). Select the parameter at a site. Click Add. You are done.

Figure 47-Screen Shot of Envidas Validation Settings

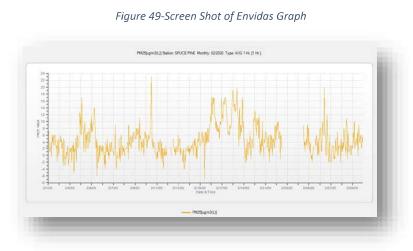
Station	's Monitors Last Validations				Date And Time	
Current	t User Name : Paul Chappin	High	est Edit Level : Final		Start Date : 2/ 1/2020 ~	
1 *	Station	Monitor	Start DateTime	Stop DateTime	Start Time : 00:00	
ŧ	BAYVIEW					
(#)	BOED				Stop Date : 2/29/2020 ~	
æ	BEAUFORT					
•	BETHANY				Stop Time : 23:59	
Ð	ZBLACKSTN					
Ð	BNTCREEK					0
(±)	BRYSON				PITTAGCT	~
(H)	BUSHYFRK				- PURCHASE	
æ	BUTNER				E SEMORA DRR	
(#)	CANDOR				B-SKYLAND DRR	
(E)	CANDOR1				SPUCE PINE	
æ	CASTLE H				1022BAMR	
Œ	CHERRYGR				PM25	
Ð	CLEMMONS				PM2.5_2	
Ŧ	COWEETA				I ZTAYLORSV	
•	CRANBERY			~	I TRPLOAK	
<	P10710 1010			>	I TYLRV13	v
٩.				>	Add Cancel	

### 2.63.4.7Validation of T640X Data

 Make a station report of the data to be validated in Envista ARM. Select the station name (e.g. Millbrook), the monitoring parameter (in this case PM<sub>2.5</sub>), output set as Tabular, monthly set as the duration and then set the start date (start date will automatically be the first of the month selected). The type of report will be average, made from an hourly time base, to an hourly time base. Click OK.

Primary AQS	Output Tabular O Graph O Excel
Purpose :	Duration
	Duration     Daily O Weekly
Region :	
All	<ul> <li>Montiniy</li> <li>Period</li> </ul>
City :	Date And Time
All	✓ Start Date:  1/2020 ✓
Organization :	Start Time : 00:00
All	v Start lime : 00:00
tation : All Stations	Stop.Date : 3/31/2020 ~
	Stop Time 23:00
All On Monitors	Type Criteria Status Add Features
146i_gas conc 1640X	AVG V Partial
T640X10	From Time Base : Use Raw
T640XLC T640XCRS	1 Hour Consultate
T640XRH	Time Base : Round Data
T640XAT T640XAP	1 Hour Summary
T640_ASC-jckt	Seperate Monitors
T640_ASC-heater T640_streamRH PM10STDA S02-Max5min	Display Monitor Unit As : Default Units ~
C	DK Cancel

2) Once the report generates, press the space bar to toggle between report and graphical views. Review the graph for unusual spikes or drops in the data and readings that are missing all together. Readings that show no change over a span of time are also of importance. Take note of any max reading larger than  $35 \ \mu g/m^3$  or negative numbers (these will never happen theoretically). Make note of these irregularities for future use in validation.



- 3) Repeat steps 1 and 2 for the PM<sub>10</sub>, PM<sub>10</sub> STD and PM Coarse parameters of the T640X.
- 4) Now review the E-log for the monitor and month being considered. Go to the P:\Ambient\Incoming\RegOffices.NC. In this example, we will select the Raleigh office, Logbook Reports, year 2020, T640X, Millbrook and March. Open the E-log.

s ^	Name	Date modified	Туре	Size
	MQ_T640X_2020_1	2/13/2020 3:30 PM	Microsoft Excel M	252 KB
ts	MQ_T640X_2020_2	3/11/2020 11:12 AM	Microsoft Excel M	254 KB
s	MQ_T640X_2020_3	4/13/2020 9:41 AM	Microsoft Excel M	255 KB
	MQ T640X 2020 4	5/18/2020 5:27 PM	Microsoft Excel M	258 KB

- 5) Check the dates and results of all calibrations, verifications and maintenance activities. Make notes on this. Does the E-log paint a clear picture of what happened during the month? If not, contact the operator for clarification. Here are some important things to look out for during your E-log review:
  - a) If a calibration was done for any reason, did a verification precede it?
  - b) When was the last calibration performed?
  - c) When was the last span dust test?
  - d) Is there a verification for this month? Are there two? Three?

- e) Is this a month in which an audit should be performed (usually the month in the middle of each quarter: Feb, May, Aug, Nov)? Were different devices used for this audit and not the same ones used to calibrate or verify?
- f) Was quarterly maintenance performed (usually at the same time as the audit, but not always)?
- g) Was monthly maintenance performed?
- h) Was quarterly maintenance performed?
- i) Was bi-annual maintenance performed?
- j) Was annual maintenance performed?
- k) Did the leak checks pass?
- Look behind a month and forward into the next month in the E-log (if available). Do you see any glaring problems that may invalidate data back into the month you are reviewing? Are there any problems in last month's data that need to be coded forward into the month you are reviewing?
- m) If a monitor was swapped out, was an ending verification done prior to the replacement?
- n) If a monitor up and died, were the data voided back to the last good verification?
- 6) Now back to Envista ARM. Select the Edit tab, then Edit Table. Choose your station, parameters, make the output tabular, duration will be monthly (date and time will self-correct for the month) and report type will be standard with the time base of one hour. Click OK.

rimary AQS	Output
urpose :	Tabular      Graph
All V	Duration
egion :	O Daily O Weekly
All V	Monthly O Period
ity :	
NI V	Date And Time
rganization :	Start Date : 3/ 1/2020 V
al V	Start Time : 00:00
itation :	Stop Date : 3/31/2020 ~
ILLBRK V	Stup Date . 3/51/2020
All 🔽 On Monitors 🤱	Stop Time : 23:00
146i_gas conc	Туре
T640X	View Style
T640XLC	Standard 🗸
T640XCRS	Time Base :
] T640XRH	1 Hour 🗸
T640XAP	Use EPA Statuses
T640_ASC-jckt V	

7) If the resulting report is green (see below) you are good to go. If it is light yellow, the second level review has not been performed. If it is brown, you have already signed off on these data.

Figure 51-Screen Shot of Envista Edit Table Window

Figure 52-Screen Shot of Envista Green Edit Report

Date & Time	PM25	Status
	[ug/m3(L)]	
2/1/20 00:00	8.0	- Ok
2/1/20 01:00	6.0	- Ok
2/1/20 02:00	3.0	- Ok
2/1/20 03:00	1.0	- Ok
2/1/20 04:00	1.0	- Ok
0.14.10.0.05.00		

Another way to find the reviewing information is to use the Validation Settings option under the Edit tab, or, under the Reports tab, use the Validation report.

- 8) Now is when we bring all the reports together. Go through and deal with anything you found while performing the first step of graphing the data (high, low, stuck or missing). Apply codes accordingly to your review and inquiry.
- 9) For an example, let's use a very high reading, surrounded by low readings (a large peak on the graph). If you and the operator have done you due diligence, and the reading is deemed valid, you will need to add some flag codes. If the reading is not valid, you will need to use a void code. In this example, we will flag it as valid. Select the value and right click. Select Enter/Change Comment Explanation/Comment.

	- Ok	7.0	2/10/20 09:00
	- Ok	9.0	2/10/20 10:00
	- Ok	13.0	2/10/20 11:00
	Enter/Change Edit Info	63.0	2/10/20 12:00
	Open Edit Block	13.0	2/10/20 13:00
n/Comment	Enter/Change Explanation/C	3.0	2/10/20 14:00
	Save Columns Size	5.0	2/10/20 15:00
nents	Clear Explanations/Commer	2.0	2/10/20 16:00
	Hide Status Columns	4.0	2/10/20 17:00
	- Ok	4.0	2/10/20 18:00
	- OK	3.0	0/10/20 10:00

Figure 53-Screen Shot of Envista Green Edit Report with an Outlier

10) Next, we see that the operator or level two reviewer has inserted a comment stating that the reading was reported in the monitor's downloaded data as the same value. Be careful to not overwrite this comment.

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10/20 06:00	5.0	- Ok	Enter Explanation/Comment	×
10/20 07:00	5.0	- Ok		
10/20 08:00	5.0	- OK	Explanation	Additional Explanations (Max 9) :
10/20 09:00	7.0	- Ok	(None)	1. Deviation from a CFR Crtical Crteria Requiremer     1. Deviation from a CFR Crtical Crteria Requiremer     10. Data reviewed and validated (ALL )     2. Operational Deviation (ALL )     3. Field base (ALL )     5. Outlier (ALL )     5. Outlier (ALL )     5. Outlier (ALL )     7. Below Lowest Calibration Level (ALL )     7. Below Lowest Calibration Level (ALL )     0. Regative value detected - zero resported (ALL )     Cc. Clean Canster Ressitive (ALL )
10/20 10:00	9.0	- Ok	Comment	
10/20 11:00	13.0	- Ok	download = 63	
10/20 12:00	63.0	- Ok		
10/20 13:00	13.0	- Ok		
10/20 14:00	3.0	- Ok		
10/20 15:00	5.0	- Ok		
10/20 16:00	2.0	- Ok		
10/20 17:00	4.0	- Ok	Add / Change Cancel	CL. Surrogate Recoveries Outside Control Limits (- 🛩
10/20 18:00	4.0	- Ok		
0.00 10.00	2.0	04		

#### Figure 54- Screen Shot of Envista Green Edit Report Explanation

### 11) First, from the drop-down menu, select a flag of "5" to mark the value as an outlier.

Figure 55- Screen Shot of Envista Green Edit Report Explanation with additional Explanation Window

2/10/20 05:00		6.0	- Ok		
2/10/20 06:00		5.0	- Ok	Enter Explanation/Comment >>	
2/10/20 07:00		5.0	- Ok		
2/10/20 08:00		5.0	- Ok	Explanation Addition	al Explanations (Max 9) : 0
2/10/20 09:00		7.0	- Ok		eviation from a CFR Critical Criteria Requiremer 🔥
2/10/20 10:00		9.0	- Ok		C. 1-Point OC check exceeds, evidence data is v     V. Data reviewe and avdiated (ALL)     Orantonal Deviation (ALL)     S. Field base (ALL)     B. GAPR base (ALL)     B. GAPR base (ALL)     Below Lowest Calibration Level (ALL)     D. Below Lowest Calibration Level (ALL)     C. Chean Caniber Residue (ALL)
2/10/20 11:00		13.0	- Ok	1C. 1-Point QC check exceeds, evidence data is vi	
2/10/20 12:00		63.0	- Ok		
2/10/20 13:00		13.0	- Ok	3. Field Issue (ALL)	
2/10/20 14:00		3.0	- Ok	4. Lab Issue (ALL) 6. 0. 5. Outlier (ALL) 7. Be	
2/10/20 15:00		5.0	- Ok	6. QAPP Issue ( ALL )	
2/10/20 16:00		2.0	- Ok	9. Negative value detected - zero reported (ALL)	
2/10/20 17:00		4.0	- Ok	CB. Values have been Blank Corrected (ALL) CC. Clean Canister Residue (ALL)	Surrogate Recoveries Outside Control Limits ( 🗸
2/10/20 18:00		4.0	- Ok	CL. Surrogate Recoveries Outside Control Limits (. EH. Estimated; Exceeds Upper Range (ALL.)	
2/10/20 19:00		3.0	- Ok	FB. Field Blank Value Above Acceptable Limit ( AL	
2/10/20 20:00		1.0	- Ok	HT. Sample pick-up hold time exceeded (ALL) IA. African Dust (ALL)	
2/10/20 21:00		1.0	- Ok	B. Asian Dust ( ALL ) IC. Chem. Spills :NDUST Accidents ( ALL )	
2/10/20 22:00		0.0	- Ok	D. Cleanup After a Major Disaster ( ALL )	
2/10/20 23:00		-1.0	- Ok	E. Demolition (ALL) F. Fire - Canadian (ALL)	
2/11/20 00:00		-1.0	- Ok	IG. Fire - Mexico/Central America (ALL) H. Fireworts (ALL)	
2/11/20 01:00		1.0	- Ok	I. High Pollen Count ( ALL )	
2/11/20 02:00		-1.0	- Ok	U, High Winds ( ALL ) K, Infreguent Large Gatherings ( ALL )	
Save	9 Undo	9 Undo All	Show Edit Info	Show El Ditter (ALL)	

12) Second, from the additional explanation window, apply the "V" flag for validated value. This helps others know that due diligence has been used in looking into the causes or lack thereof. The value will turn blue to show that comments or flags have been applied. This value is good to go.

2/10/20 05:00	0.0	- UK		
2/10/20 06:00	5.0	- Ok	Enter Explanation/Comment	3
2/10/20 07:00	5.0	- Ok		
2/10/20 08:00	5.0	- Ok	Explanation	Additional Explanations (Max 9) :
2/10/20 09:00	7.0	- Ok	5. Outlier (ALL )	RP. Structural Fire (ALL)
2/10/20 10:00	9.0	- Ok	Comment	R0. Terrorist Act (ALL) RR. Unique Traffic Disruption (ALL)
2/10/20 11:00	13.0	- Ok	download = 63	RS. Volcanic Eruptions (ALL )
2/10/20 12:00	63.0	- Ok		RT. Wildfire-U. S. (ALL)  SQ. Values Between SQL and MDL (ALL)
2/10/20 13:00	13.0	- Ok		SS. Value substituted from secondary monitor (AL
2/10/20 14:00	3.0	- Ok		SX. Does Not Meet Siting Criteria (ALL) TB. Trip Blank Value Above Acceptable Limit (ALL
2/10/20 15:00	5.0	- Ok		TT. Transport Temperaure is Out of Specs. (ALL.)
2/10/20 16:00	2.0	- Ok		V. Validated Value (ALL) VB. Value below normal; no reason to invalidate (
2/10/20 17:00	4.0	- Ok	Add / Change Cancel	W. Flow Rate Average out of Spec. (ALL)
2/10/20 18:00	4.0	- Ok		

Figure 56- Screen Shot of Envista Green Edit Report Explanation with additional Explanation Window

13) Now, using your notes from the E-log review, apply codes to the hours in the edit table where calibrations, maintenance, verifications, zero backgrounds and other events took place. Void the appropriate number of hours to ensure the T640X has stabilized and is once again collecting valid data. If the operator performed more than one activity and voided more than one hour, ensure the operator used different null codes for the two hours so as to "tell the story" of what happened at the site. Review the list in step 5 for anything you may have missed.

2/7/20 08:00	1.0	- Ok
2/7/20 09:00	-1.0	- Ok
2/7/20 10:00	3.0	AX - Precision
2/7/20 11:00	-15.0	BA - Maintain
2/7/20 12:00	5.0	- Ok
2/7/20 13:00	-1.0	- Ok 🗸
2/7/20 14:00	2.0	- Ok

Figure 57- Screen Shot of Envista Green Edit Report "Telling the Story"

14) Once you are happy with your review, click the save icon. Now go to Validation Settings in the Edit tab. Select the time range you would like to validate (usually a whole month at a time). Select the parameter at a site. Click Add. You are done.

*Figure 58-Screen Shot of Envidas Validation Settings* 

	Monitors Last Validations User Name : Paul Chappin	High	est Edit Level : Final		Date And Time Start Date :	5/28/2020 ~	
1 *	Station	Monitor	Start DateTime	Stop DateTime	Start Time :	00:00	
Ŧ	BAYVIEW						
(±)	BDED				Stop Date :	5/28/2020 ~	
Đ	BEAUFORT				Stop Date :	5/28/2020 ~	
±	BETHANY				Stop Time :	23:59	
(F)	ZBLACKSTN						
(±	BNTCREEK						
(±)	BRYSON					_Bkg gas conc	^
<b>(</b>	BUSHYFRK				- BAN		
Đ	BUTNER						
±	CANDOR						
ŧ	CANDOR1				T64		
±	CASTLE H					XCRS	_
±	CHERRYGR					XRH	
Đ	CLEMMONS				SO2	T_5MIN	
(±	COWEETA				T64		
Ŧ	CRANBERY						1223
-	CROUPE			×	T64	ASC-jckt	~
<				>	Add	Cancel	

#### 2.63.4.8 Validation of CSN Data

In the mid-1990s, Sonoma Technology, Inc. (STI) developed a software program, VOCDat (<u>Volatile Organic Compound data validation and analysis software tool</u>) for validating and analyzing PAMS (Photochemical Assessment Monitoring Station) data. Many monitoring agencies have used VOCDat to validate and analyze PAMS data and other large sets of speciated ambient data (e.g., carbonyls, air toxics, or speciated PM2.5).

Along the same lines as VOCDat, DART (Data Analysis and Reporting Tool) is an STI webbased data validation and analysis system that is integrated with AirNow-Tech. It not only provides a framework for validating and analyzing air quality data, but it will also eventually enable access to complementary data sets from different sources and web services.

In its current form, DART contains many key features for validating and analyzing data collected, such as routine air quality measurements (e.g., PM, O3, NOx), routine meteorological measurements, and VOC measurements.

- 1) Electronic Logbook Review
  - a) Now review the E-log for the monitor and month being considered. Go to the P:\Ambient\Incoming\RegOffices.NC\Raleigh\Logbook Reports\2020\SPECIATION\Millbrook SASS and URG. Open the E-log.
  - b) Check the dates and results of all calibrations, verifications and maintenance activities. Make notes on this. Does the E-log paint a clear picture of what happened during the month? If not, contact the operator for clarification. Here are some important things to look out for during your E-log review:

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- If a calibration was done for any reason, did a verification precede it?
- When was the last calibration performed?
- Is there a verification for this month? Are there two? Three?
- Is this a month in which an audit should be performed (usually the month in the middle of each quarter: Feb, May, Aug, Nov)? Were different devices used for this audit and not the same devices used to calibrate or verify?
- Was quarterly maintenance performed (usually at the same time as the audit, but not always)?
- Was monthly maintenance performed?
- Did the leak checks pass?
- Look behind a month and forward into the next month in the E-log (if available). Do you see any glaring problems that may invalidate data back into the month you are reviewing? Are there any problems in last month's data that need to be coded forward into the month you are reviewing?
- If a monitor was swapped out, was an ending verification done prior to the replacement?
- If a monitor up and died, were the data voided back to the last good verification?
- 2) Opening Dart
  - a) To get started with DART, use an Internet browser to navigate to AirNow-Tech (<u>http://airnowtech.org</u>). Google Chrome is the preferred Internet browser; however, Firefox and Internet Explorer version 10 or above are also supported.
  - b) Next, log in with a new or existing account. Choose to login at the upper right corner of the main page.

Figure 59-Screen Shot of Air Now Log In

AirNow	Agencies blas heroge	tor beta Paracasta Patting Hat	that from Associates
And a second second			
Apple Transportions problem in primarily work to the Sector	Please log to to sole AirNow Tech		
department was that provide a collect, and wall provide and allowed accellents	Usename [		
<ul> <li>Access from the part of the local sector of the local</li></ul>	Paraword		all brain and el dath
<ul> <li>Hotor served articize</li> <li>House and article article</li> <li>Configure Encoding to</li> </ul>	Lea in	Forget your passworth	Conception of
<ul> <li>- Asserting and if an all</li> <li>- Trace Tracemong and if</li> <li>- Descripts and register</li> <li>- Descripts 200 register</li> </ul>	Research an Arthorn Sach Account		CONTRACTOR
A Party for the extremited	a block	ar 10 10	

c) Find DART under the tools tab on the AirNow-Tech home page.

Figure	60-Screen	Shot o	f Air	Now	Tool	Tab
--------	-----------	--------	-------	-----	------	-----

AITNOW	Dies Navigeor Data Prostant Pulling Multi Churk Deurses
(man)	Putting Summery
Affice Tell is a particular there we also to an authority of a start to a sta	Care Segue
al pintardy upid to the todeol. State. Total: and total an availy regardations that an active table and finestable to the nintexe	Connect Palance 21: 5 Anno 42 Connect Server Streng and Anno 40
system, as and all expenditions and other an ones it prime space to	Augustin 2014 (ALS 2017) URANA AN AUGUST
increase membring alle data information, and politing     place	
	Apres One Philip Phil

d) Next, you will see the DART welcome page, which explains the three 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.

Figure 61-Screen Shot of DART Welcome Page

Welcome to DART	Manage ) Explore 1 Vallage ( Explort 1 mag
SART in your personal platform for air quality thats initiation and analysist	200
You call uploat your own an guality tata or request 8 mm AQS Data Mart	
Diversity prophy and use centum sciencing checks Ter	MAGE R
Vid ose the DART export to prepare data for AQS administration	Mar
Aletty an emotion tory writerar (in OART more king	the state of the s
1015 (ant)	and the second at the second a
Here's how to get started	
Add data to DART	

- e) DART is organized into three general areas:
  - Data Manager upload and manage your data sets.
  - Data Explorer screen, validate, and explore your data using time series graphs, scatter plots, and bar charts.
  - Data Validator build and run automated screening checks and interactively explore results and your data using linked tables and time-series graphs.
  - Data Exporter export your data files and prepare them for submission to AQS.
- f) You can access each area by clicking on the manage, explore, validate, and export links at the top right of every screen. The help link at the top right of the screen opens the DART help guide in a separate window.

#### 3) Validating CSN Data within DART

On the manage page, you can begin to run screening checks to automatically identify problematic data, in order to make data validation more efficient.

a) To begin, click on the approval status icon.

Figure 62-Screen Shot of DART Manage

9	ow	Dashboard Data		Polling Notifier	EnviroFlash	Tools	Help
DART				Manage   Expl	ore   Validat	e   Export	Help
North Ca	rolina [	DENR - Divison (	of Air Quality Data	Sets Data Scelar	Developed	Approvel Status	•
-					Download	Approved Status	•

- b) 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.
  - Time series and fingerprint plots for visually reviewing the data.

Air	Now	0		Walturn	a Pari Despri (My Access)   Co	octas itegos
9	NOW	Davitboard Da	a Navigator f	forecasts Politing	Notifier Environitiant Th	ols Help
DART				Manag	w i Explore i validate i	cipiint i melo
1.0		- 371830014 C				Seint Balth
G Batch : Total Sampler		D4/12/2018 - Review Date Range: 01-01-2017				
Deter	Species	Tread Qualifiers	Total Null Codes	Mill (54) TT (522) Della Campletenana	Data Above Detection	Mary July
09/01/2017	69	38 (TT FA MD MA)	-0.	100%	50%	
110240400	60	30 (TT PL MD MK)		100%	329	٥
	80	SH LTT NO MO		100%	52%	
09/87/2017	60	SE (TT FX MD)	0	1009	40%	0
09/67/2017		100/TT MDS	Π.	1009	50%	0
09/10/2017 09/13/2017	104					
09/10/2017	104	SI (TT NO MIL	٥	100%	35m	0
09/10/2017 09/13/2017		SH (TT NO MK) SH (TT NO MK)	0 0	100%	25% 17%	0
09/10/2017 09/13/2017 09/16/2017	60					
09/10/2017 09/13/2017 09/16/2017 09/16/2017	60 90	SH (TT MD MX)	a	1009	97%	0

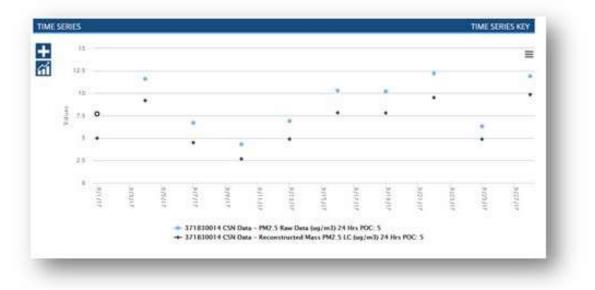
Figure 63-DART Approval Window

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Figure 64- DART Batch Window

leview	ed Date 🗛	Parameter 4.1	NOC	Veloc	Pile	MOL	Unc	Unit:	Null Code	Qual. Code	Comments	
8	08/01/2017	Alumetum PM2.51C	5	0.06459	-93	0.03276	0.02572	lug/w3	12	TT	(8	ii.
Q;	09/01/2017	Ammonium ion PN2.5 LC	(\$	5.974		0.00196	0.00119	ugin3	08	TT, MD	Q.	
0	09/01/2017	Ammonium Nitrate PM2.5 LC	- 5	0.22719	23	0.01726	0.02021	Ugin3	17	π	(r	
Q,	09/01/2017	Ammonium Sulfate PM2.5 LC	.5	1.08135	20	0.01532	0.06759	ug/m3	12	π	a.	
0	09/01/2017	Antimony PM2.3 LC	5		39	0.03879	0-02386	upin3	8	TT, MD	02	
0	09/01/2017	Arsenic PM2.5 LC	\$	-1,06-5	24	0,00418	0.00254	vg/m3	08	TT, MD	12	
80	09/01/2017	Average Ambient Pressure for URG3000N	1	749.8	- 26	0.0		mining	a.	TT: FX, MX	=	
	09/01/2017	Average Ambient Temperature for URG3000N	5	23.4	44	0.0		×C.	(F	TT. FX. MX	æ	
0	09/01/2017	Avg Ambient Pressure for MetOrie SASS/SuperSASS	-\$	749.0	- 85	0.0		mong	12	π	(F	

#### Figure 65-Time Series Window



- c) In approval mode, null and/or qualifier codes can be edited using the edit batch window.
- d) 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.
- e) Choose the species or group of species that you would like to edit. The options include:

- Selected Species: Only the species selected in the batch data table will be changed. The row for the selected species in the batch data table will be highlighted in blue.
- Entire Sample: All of the species for the selected sample date will be changed. For example, if the row for the Potassium ion concentration is selected and "Apply to Entire Sample" is chosen from the drop-down menu, the null and/or qualifier code(s) for all of the species measured in the sample will be changed.
- Metal Species in Selected Sample: All of the metal species for the selected sample date will be changed. For example, if the row for the Aluminum concentration is selected and "Apply to Metal Species" is chosen from the drop-down menu, the null and/or qualifier code(s) for all of the metal species measured in the sample will be changed.
- Ions Species in Selected Sample: All of the ion species for the selected sample date will be changed. For example, if the row for the Ammonium ion concentration is selected and "Apply to Ions Species" is chosen from the drop-down menu, the null and/or qualifier code(s) for all of the ion species measured in the sample will be changed.
- Carbon Species in Selected Sample: All of the carbon species for the selected sample date will be changed. For example, if the row in the batch data table for the Elemental Carbon (EC) concentration is selected and "Apply to Carbon Species" is chosen from the drop-down menu, the null and/or qualifier code(s) for all of the carbon species measured in the sample will be changed.
- f) When reviewing data, it can be tempting to remove points that do not "fit" an observed profile. However, it is critical to retain all viable data points for an unbiased dataset. Clear evidence, such as sampler malfunction or sample damage, is required for a sample or data to be invalidated. There are numerous qualifier flag options to inform the end user. Similarly, negative values are included in the final dataset as they arise from the subtraction of background signals and can be understood as "indistinguishable from zero. Censoring negative values artificially biases the dataset and can be problematic for statistics.
- g) Other things to keep in mind and look for while validating data include the following:
  - Check all invalid filters. Please review the null flags and cross-check with field records.
  - Change the "AM" null flag to a more appropriate flag. The "AM" (miscellaneous void) null flag is automatically applied to data records that were not received.

- Add qualifier flags. AQS will accept up to 10 qualifier flags for each data value reported to AQS.
- Invalidate samples with a serious sampling problem. Serious sampling problems include poor flow rate (> +/-10% from specification) and inadequate sampling time (> +/-1 hour).
- Check field blank concentrations. Higher than expected concentrations could indicate sampler issues, filter set-up and run issues, or contamination.
- Check flow rates, dates and operational parameters carefully.
- Respond to questions in the comments section. UCD data analysts ask questions to the SLT validator through the DART interface. In order for these issues to be resolved, the SLT validator must leave a clear and detailed comment responding to the question.
- Write clear and detailed comments. The SLT validator must clearly indicate when action is required by the UCD data analysts, and specify the parameter(s), date(s), and describe the changes that need to be made.
- Be careful when applying flags to multiple parameters.
- Review data flagged with the "A1", "B1", and/or "C1" flags.
- h) Do not perform the following:
  - Invalidate samples with the "FX" or "MX" qualifier flags unless additional information support invalidation.
  - Remove the "TT" and "MD" flags. These flags are automatically generated from measurement results. The "TT" flag is applied when samples are received with a temperature greater than 4 °C. The "MD" flag is applied when the reported value is below the corresponding detection limit.
  - Use the "Rx" Request Exclusion flags. These flags are available for use for NAAQS related data but they are not relevant to CSN data.
- i) 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.
- j) 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.
- k) 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. If a species concentration is missing, which displays as the value -999 in DART, a null code is required.

- 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.
- m) Click "Save" to apply your changes or click "Cancel" to exit the window. By default, only 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) that are currently applied to the species or a group of species (e.g., metals, ions, entire sample) 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. This option can be invoked by checking the "Overwrite Codes" box next to the "Apply to" drop-down menu.
- n) After the 30-day review period, CSN data are automatically sent back to the laboratory; data that were not marked as reviewed are assumed to be approved by the agency.
- o) 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.
- p) Watch a <u>webinar</u> from March 2016 for more information about using approval mode for the CSN review process.
- 4) Further Analysis

The DART interface provides many useful tools for visualizing the data sets. In addition to the online DART interface, DART allows users to export data for further analysis using a spreadsheet or other software. There are innumerable methods for data analysis, which are outside the scope of this document. Offered here are some examples of analyses that may be useful for SLT validators both using the DART interface and offline. Other useful analyses not covered in this document may incorporate wind rose plots, trajectory analysis, and AirNow-Tech data.

a) *Regression analysis* is a common tool used for evaluating the relationship between two or more interrelated variables. For data validation, linear regression can be used to determine the comparability of two types of results, such as reconstructed mass versus gravimetric mass or titanium versus silicon (typical soil elements). For measurements we expect to be very similar, a regression slope near one would indicate subjectively good agreement. A slope that deviates from one may indicate a methodological bias by one instrument or analysis. Likewise, a non-zero intercept indicates a bias between the two variables. The analyst should take uncertainties, methodological differences, and local factors into account when interpreting results.

- b) In DART, *time-series plots* can be viewed for one or more parameters simultaneously. Additionally, several calculated parameters are provided to aid in interpreting the data. These include reconstructed mass, summed elements, summed ions, ammonium sulfate, ammonium nitrate, soil, and organic carbon by mass. Viewing multiple parameters across different filter types can be a useful tool for determining whether a data point is atmospherically real or a sampling anomaly. For species with common sources, comparing their concentrations can provide supporting evidence if they exhibit similar trends. For example, if sodium ion and chloride both have high concentrations it can be indicative of sea salt influence. However, if the concentrations of all ions species are high, this could indicate an issue with the sample itself, as not all of the measured species from the nylon filter have a common source. Comparing the sulfate from the nylon filter with the sulfur from the corresponding PTFE filter could be used to corroborate the results.
- c) Comparing species concentrations between sites can provide insight into local and regional events as well as highlight potential issues with the data. When performing a *geospatial analysis*, it is important to consider the site location relative to other CSN sites and potential local influences. It is also important to understand the sources and atmospheric lifetimes of the species being compared; for example, sulfur is generally regional whereas organic carbon can have local and regional sources and evolves in the atmosphere with time.

#### 2.63.4.9Acronyms

- AM AQS null code signifying a miscellaneous void
- AQI Air Quality Index
- AQS Air Quality System
- ARM Air Resource Manager
- BAM beta attenuation monitor
- CFR Code of Federal Regulations
- CSN Chemical Speciation Network
- DART Data Analysis and Reporting Tool
- EC Elemental Carbon
- EPA United States Environmental Protection Agency
- FEM Federal Equivalent Method
- FRM Federal Reference Method

#### FTP – File transfer protocol

- IBEAM Internet-Based Enterprise Application Management
- MDL Method Detection Limit

MS - Microsoft

- NAAQS National Ambient Air Quality Standard
- NC DAQ North Carolina Division of Air Quality
- NO<sub>x</sub> Nitrogen oxides or oxides of nitrogen

O<sub>3</sub> - Ozone

- PAMS Photochemical Assessment Monitoring Station
- PM Particle matter
- PM<sub>2.5</sub> Fine particles, i.e., particles with aerodynamic diameters of 2.5 microns or less
- $PM_{10}$  particles with aerodynamic diameters of 10 microns or less
- PTFE-Polytetra fluoroethylene
- QA quality assurance
- QAPP quality assurance project plan

- RCO Raleigh Central Office
- SASS Speciated Air Sampling System
- SCC sharp cut cyclone
- SLT State, Local, Tribal programs or agencies
- SOP standard operating procedures
- STI Sonoma Technology, Incorporated
- STP standard temperature and pressure
- UCD University of California Davis
- URG University Research Glass
- $\mu g-microgram$
- $\mu g/m^3 micrograms$  per cubic meter
- VOC Volatile Organic Compounds
- VOCDat (Volatile Organic Compound data validation and analysis software tool)
- VSCC very sharp cut cyclone
- WNC Western North Carolina Regional Air Quality Agency

### 2.63.4.10 Revision History

New SOP

#### 2.63.4.11References

- EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program January 2017
- EPA Guidance on Environmental Data Verification and Data Validation EPA QA/G-8 November 2002
- Guidance for Preparing Standard Operating Procedures (SOPs) EPA QA/G-6 April 2007
- Quality Assurance Project Plan for the North Carolina Division of Air Quality Particulate Matter Monitoring Program August 2018
- DART Training for PAMS and CSN (Data Analysis and Reporting Tool for Photochemical Assessment Monitoring Station and Chemical Speciation Network Data) August 2016
- CSN DART Webinar on July 25, 2018

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Final Audit Report

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