Florida Department of Environmental Protection

Data Review, Validation & Verification

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Data Validation Team

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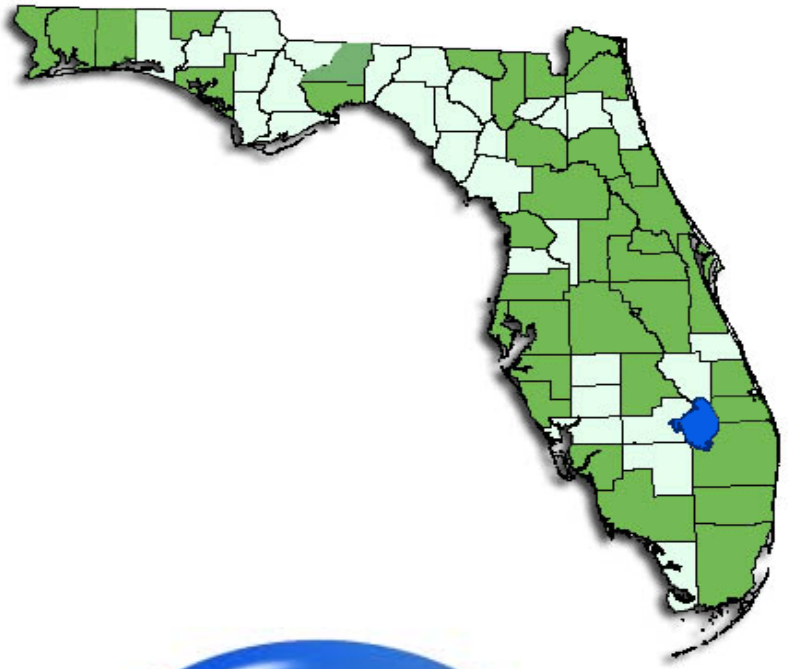
Purpose

- To ensure that the highest level of legally defendable air monitoring data is produced by the State of Florida

- To identify necessary revisions and correct data prior to submittal to AQS.



AQS

Launch Web Application

Data Validation Team

- The objectives of the Data Validation Team are:
  a) Provide additional level of service to agencies and local programs with the data verification process.
  b) To enhance the consistency of documentation and the data validation process, statewide.
  c) To provide an objective reviewable process of the air monitoring data.

Importance of Validation

- It is the monitoring agency's responsibility to prevent, identify, correct and define the consequences of monitoring difficulties that may affect the precision and accuracy, and/or the validity of the data.

- Serious errors in data analysis and procedural performance can cause erroneous data values

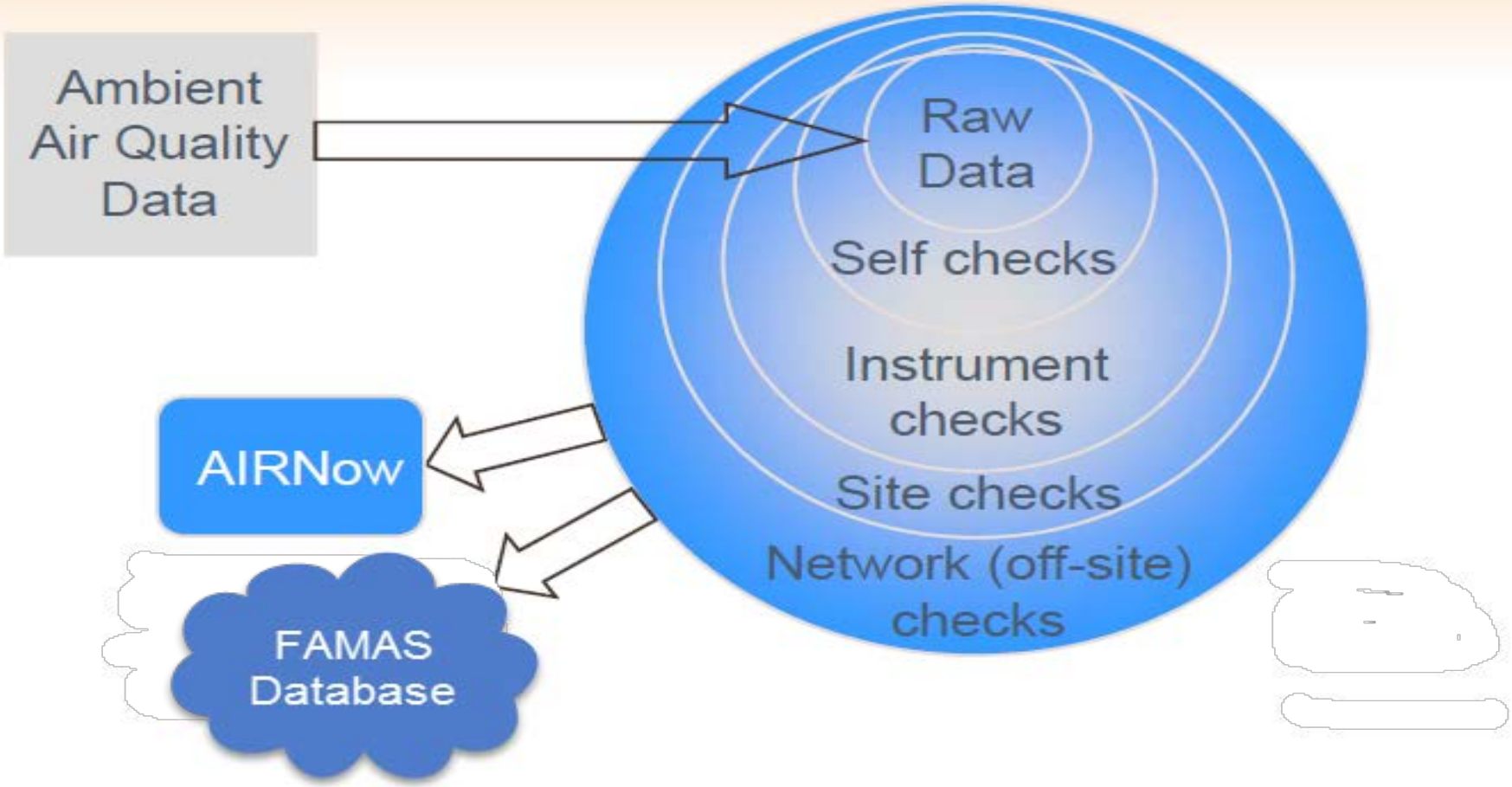
- Accurate information and precise attention to details improves the quality of the data collected.

How Has the Data Validation Process Changed?

- More data being collected
- New instruments
- Better computing
- Better tools (e.g., visualization)
- Improved communication (allows remote access and frequent review)

Provides ability to assemble data/metadata all in one place and allows a more efficient validation and review process.

Automated Quality Assurance Checks



Vital Components of Data Validation

- Data review, verification and validation are techniques used to accept, reject, or qualify data in an objective and consistent manner.
  - Review: refers to the re-examination of the efficiency and effectiveness of the protocols and procedures currently implemented.
  - Verification: refers to the assessment of transformational accuracy of the data and addresses whether it is done correctly.
  - Validation: refers to the assessment of the representational accuracy of the data and provides objective evidence that the data was obtained and documented correctly.

Data Validation

- Data review and validation is an ongoing process that is performed by the field operators and agency QA staff.
- At a minimum, a cursory review of data should be performed daily, preferably in the morning, to provide a status of the data and instrument's performance.
- A detailed analysis is performed through the revision of the site's documentation including maintenance and calibration records for the equipment.

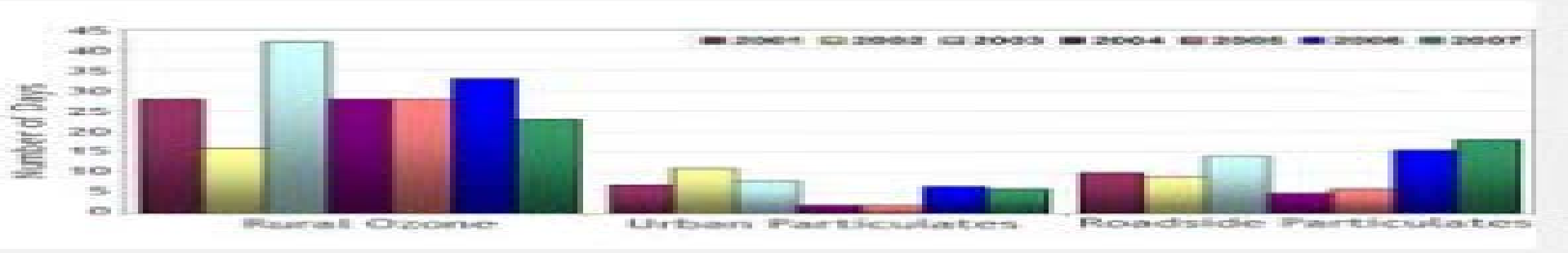
Data Validation

- Data Review includes:
  - Reviewing site documents such as maintenance calibration logs
  - Identifying extreme values and outliers
  - Ensuring that the QC flags placed on the data by the Field Technicians is carried into the final dataset.
- Data Verification includes:
  - Evaluating the completeness, correctness, and compliance data and documentation against the required methods and procedures (SOPs).
  - Ensuring that the records produced are transparent and in compliance with the set requirements.
- Data Validation includes:
  - Inspecting the data for issues missed by the automated checks.
  - Accepting or rejecting the monitoring data based upon the results of the operational checks.
  - Ensuring that the automated flags and codes correctly identified any and all suspect/invalid data.

Data Validation

There are multiple levels to Data Validation Process!

- Data review starts in the field.
  - Field Technicians are familiar with the data and the equipment and this knowledge is crucial to the data review process.
- QA staff sign off on paperwork stating that they validate the work done in the field.
- The verified and validated data is sent to AQS after an additional revision by the AQS Coordinator.
- A final review is done by each agency, via the AQS reports, to ensure that the uploaded data is complete and accurate.



The Revision and Validation Process

- Are serial numbers of equipment accurate?
- Are the preventative maintenance schedule due dates being met?
- Do the dates on site visit forms, Z/S/P, calibration, PM schedules, etc. all match?
- Are the dates on the form of annually certified equipment correct?
- Are the forms filled out completely? Are strikethroughs and N/A's used in required fields to indicate those fields will not be used?
- If a correction was made on the form does the change have an initial and date next to it?
- Are the control limits of the maintenance checks being met? If not, make sure the appropriate actions have been taken to bring the equipment back into optimal operating conditions.
  - Does a corrective action form need to be filled out?
  - Does data need to be invalidated? Flagged?
- Does the date on the form match the date in the database showing when the maintenance was performed?

The Revision and Validation Process

- Are there enough comments on the paperwork for anyone to look at it and easily understand what took place?
- Is the form signed and dated by both the field tech and the reviewer? If electronic, is the form locked from editing after the final review?
- Have the proper null codes that accurately describe the work done in the field been applied to the data?
- Was the machine put in maintenance the entire time work was being performed? Did the machine stabilize properly before it was taken out of maintenance?
- Shelter temperature within range?
- If there were any exceedances, was an exceedance report filled out and comments added in FAMAS describing the cause?

Data Validation Tools

- **Useful tools for data validation**
  - CFR Requirements
  - QA Handbook ("the redbook")
    - Pay attention to the critical criteria!
  - QAPPs, SOPs & Data Validation Checklist
    - These are your "contracts" with EPA.
  - QA/QC checks
    - Perform the necessary checks on the equipment and enter ALL (passing and failing) checks in FAMAS.
  - Audits
    - Remember, we do not invalidate data based on audits!

Verification in FAMAS

Before you verify the data in FAMAS run the Verification Utility to help you:

- Spot any blanks in the ambient data that need to be addressed.
- See if the data was outside the range or below Federal MDLs that AQS will accept.
- Check on persistence to see if a monitor was reading the same concentration for prolonged periods of time.
- Note failed precision checks and make sure actions were taken, if needed.
- Check that all precision and accuracy data (a.k.a. QA Transactions) have been entered.

PQAO

- As one PQAO we all need to follow the same set of data validation rules and procedures.
- Air Monitoring, Data Handling & Data Validation SOP:
  - Having working knowledge of the procedures and guidelines.
  - Use only the approved forms.
  - Use the Data Validation Checklist as a general step-by-step guide.
  - Be consistent with the use of null codes and qualifiers.
    - When the data coding is done differently by each agency, it sends red flags to EPA about the quality of Florida's data.

Data Requirement

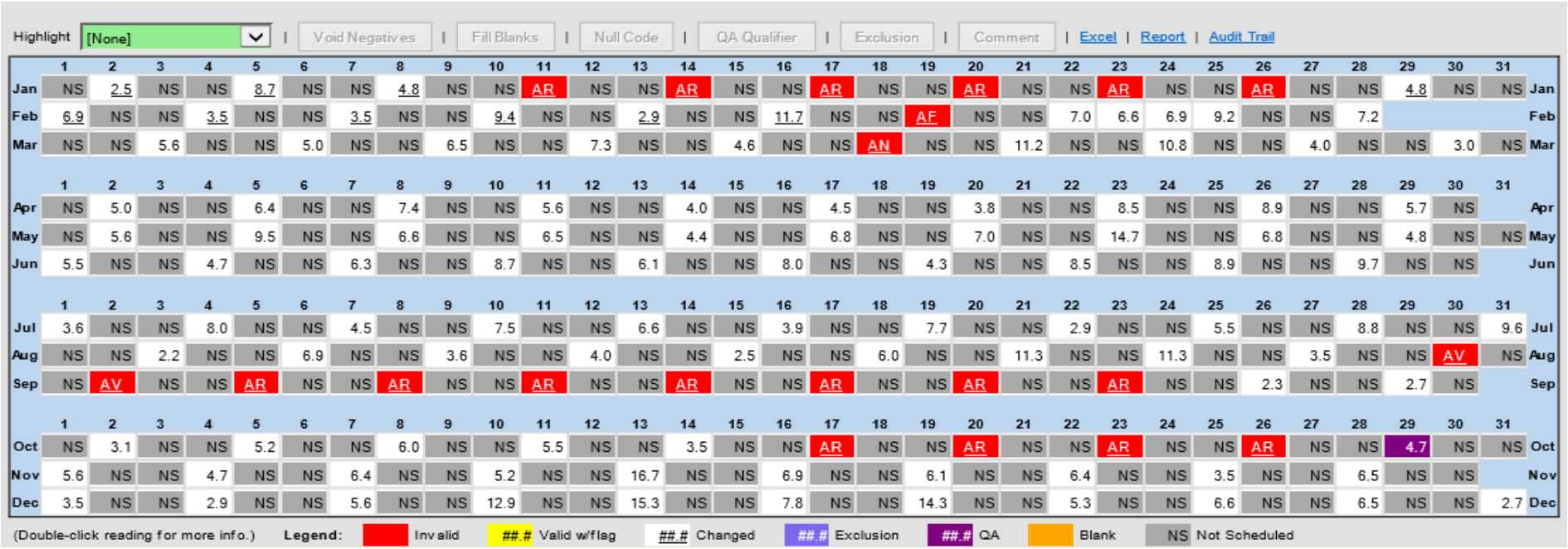
Having legally defensible data that can be used for attainment designations is our ultimate goal!

Data Validation & Flagging

- 40 CFR 58, Appendix A:
  - "For each calendar quarter, each reporting organization shall report to AQS directly the results of ***all valid*** precision and accuracy tests it has carried out during the quarter…"
- EPA does not want results from invalid tests or tests that occurred during a time period for which ambient data immediately before or after was invalidated.
- However, in Florida, we want ALL checks to be in FAMAS so there is a record of why the data might have been invalidated.

Data Validation & Flagging

- Data Revision and Reporting:
  - Null codes *invalidate* data.
  - QA Qualifiers do not invalidate data but *qualify* it to allow additional commentary about the data.
  - Use of both null codes and qualifiers allows you to more accurately describe the "story" of the data.


Highlight [None] | Void Negatives | Fill Blanks | Null Code | QA Qualifier | Exclusion | Comment | Excel | Report | Audit Trail

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Jan	NS	2.5	NS	NS	8.7	NS	NS	4.8	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	4.8	NS	NS	Jan
Feb	6.9	NS	NS	3.5	NS	NS	3.5	NS	NS	9.4	NS	NS	2.9	NS	NS	11.7	NS	NS	AF	NS	NS	7.0	6.6	6.9	9.2	NS	NS	7.2				Feb
Mar	NS	NS	5.6	NS	NS	5.0	NS	NS	6.5	NS	NS	7.3	NS	NS	4.6	NS	NS	AN	NS	NS	11.2	NS	NS	10.8	NS	NS	4.0	NS	NS	3.0	NS	Mar
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Apr	NS	5.0	NS	NS	6.4	NS	NS	7.4	NS	NS	5.6	NS	NS	4.0	NS	NS	4.5	NS	NS	3.8	NS	NS	8.5	NS	NS	8.9	NS	NS	5.7	NS		Apr
May	NS	5.6	NS	NS	9.5	NS	NS	6.6	NS	NS	6.5	NS	NS	4.4	NS	NS	6.8	NS	NS	7.0	NS	NS	14.7	NS	NS	6.8	NS	NS	4.8	NS	NS	May
Jun	5.5	NS	NS	4.7	NS	NS	6.3	NS	NS	8.7	NS	NS	6.1	NS	NS	8.0	NS	NS	4.3	NS	NS	8.5	NS	NS	8.9	NS	NS	9.7	NS	NS		Jun
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Jul	3.6	NS	NS	8.0	NS	NS	4.5	NS	NS	7.5	NS	NS	6.6	NS	NS	3.9	NS	NS	7.7	NS	NS	2.9	NS	NS	5.5	NS	NS	8.8	NS	NS	9.6	Jul
Aug	NS	NS	2.2	NS	NS	6.9	NS	NS	3.6	NS	NS	4.0	NS	NS	2.5	NS	NS	6.0	NS	NS	11.3	NS	NS	11.3	NS	NS	3.5	NS	NS	AV	NS	Aug
Sep	NS	AV	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	2.3	NS	NS	2.7	NS		Sep
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Oct	NS	3.1	NS	NS	5.2	NS	NS	6.0	NS	NS	5.5	NS	NS	3.5	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	AR	NS	NS	4.7	NS	NS	Oct
Nov	5.6	NS	NS	4.7	NS	NS	6.4	NS	NS	5.2	NS	NS	16.7	NS	NS	6.9	NS	NS	6.1	NS	NS	6.4	NS	NS	3.5	NS	NS	6.5	NS	NS		Nov
Dec	3.5	NS	NS	2.9	NS	NS	5.6	NS	NS	12.9	NS	NS	15.3	NS	NS	7.8	NS	NS	14.3	NS	NS	5.3	NS	NS	6.6	NS	NS	6.5	NS	NS	2.7	Dec

(Double-click reading for more info.) Legend: Invalid | ##.# Valid w/flag | ##.# Changed | ##.# Exclusion | ##.# QA | Blank | NS Not Scheduled

Data Validation & Flagging

How/When to use Null Codes

Null Code	When to Use
AE	Shelter temperature out of limits (Temperature should be within limits defined by the Equivalency Reference Method approved by EPA).
AG	Sample time out of limits
AH	Sample flow rate out of limits
AN	Machine malfunction (used for equipment failure)
AV	Power failure
AY	QC control point (zero/span) checks
AZ	QC Audit (Audits completed by the agency itself – local program agencies)
BA	Maintenance/routine repairs (TEOM flow audits)
BF	Gaseous analyzers zero, precision & span check
BC	Gaseous analyzers multi-point calibrations
BL	QA Audits (Audits completed by an outside agency such as DEP or EPA)
DA	Aberrant data (corrupt files, spikes, shifts) – used for any data below acceptable limits (for example, TEOM negative data)

Data Validation & Flagging

- How/when to use QA Qualifiers:
  - Should be applied whenever questionable issues regarding sampling data is noted, however no critical criteria limits have been exceeded.
  - The Qualifier Code selected most appropriate description from list.
  - Comments must be added to clarify reason for Qualifier Code

Avoid Application of Null Codes Below

AI	Insufficient Data (Cannot Calculate)
AM	Miscellaneous Void
AT	Calibration (change code during ZSP check)

Reports & Task Schedules

Data Validation Due Dates

- **Monthly:**
  - It must be uploaded to FAMAS within *20 days* from the end of each month.
    - ➢ This includes 1-point QC checks, flow checks, and any audits that occurred within the month.
- **Quarterly:**
  - Within *40 days* after the end of each quarter:
    - An email should be sent to the Data Validation Inbox with:
      1) Confirmation that all the data has been verified and validated.
      2) Data Validation Checklist
      3) FAMAS Data Completeness Report (signed by the QA coordinator)
      4) Memo stating which parameters were below 75% and why (if applicable).
      5) Corrective Action/Missing Data Report (if applicable).

Reports & Task Schedules

AQS Due Dates

- **Ambient Data:**
  - Within *15 days* after the upload of an agency's data into AQS:
    - An email should be sent to the Data Validation Inbox with:
      1) Confirmation that there were no discrepancies between the data in FAMAS and the data in the AMP501 and AMP504 AQS reports.
      2) AMP430 Completeness Report (1st page only and signed by the QA coordinator)
- **Toxics Data:**
  - Within *15 days* after the upload of an agency's data into AQS:
    - An email should be sent to the Data Validation Inbox with:
      1) Confirmation that there were no discrepancies between the data in FAMAS and the data in the AMP501 AQS report.

***Only Pinellas and Hillsborough Counties will need to run the AMP504 and confirm there were no issues with that report as well.*

Ozone Validation Template

Ozone Validation Template

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
One Point QC Check Single analyzer	*1/ 2 weeks*	≤ ±7% (percent difference)	1 and 2) 40 CFR Part 58 App A Sec 3.2 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.2. QC Check Conc range 0.01 - 0.10 ppm, relative to routine concentrations
Zero/span check	1/ 2 weeks	Zero drift ≤ ± 1.5 ppb Span drift ≤ ± 7 %	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA -OZONE			
Shelter Temperature Range	Daily (hourly values)	20 to 30° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2 Generally the 20-30 ° C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30 ° C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	≤ ± 2° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	1/6 mo	± 2° C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Annual Performance Evaluation Single analyzer	*Every site 1/year within period of monitor operation, 25 % of sites quarterly*	Percent difference of audit levels 3-10 ≤ ±15% Audit levels 1&2 ± 1.5 ppb difference or **± 15%**	1 and 2) 40 CFR Part 58 App A sec 3.2.2 3) Recommendation- 3-audit concentrations not including zero. AMTIC guidance 2/17/2011 http://www.epa.gov/ttn/amtic/cpreldoc.html
Federal Audits (NPAP)	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 1.5 ppb difference all other levels percent difference ± 10%	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration of standard of higher level 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed daily	All points within ± 2 % of calibration range of best-fit straight line Linearity error <5%	1) 40 CFR Part 50 App D 2) Recommendation 3) Recommendation- Linearity error 40 CFR Part 50 App D Multi-point calibration (0 and 4 upscale points) 40 CFR Part 50 App D sec 5.2.3
Zero Air/Zero Air Check	1/year	Concentrations below LDL	1) 40 CFR Part 50 App D Section 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			
Certification/recertification to Standard Reference Photometer (Level 1)	1/year	single point difference ≤ ± 3%	1) 40 CFR Part 50 App D Section 5.4 2 and 3) Transfer Standard Guidance EPA-454/B-10-001

$PM_{2.5}$ Validation Template

Continuous PM2.5 Local Conditions Validation Template

NOTE: There may be a number of continuous monitors that may be designated as an FEM or an ARM. These monitors may have different measurement or sampling attributes that cannot be identified in this validation template. Monitoring organizations should review specific instrument operating manuals to augment this validation template as necessary. In general, 40 CFR Part 58 App A and 40 CFR Part 50 App L requirements apply to Continuous PM2.5

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- $PM_{2.5}$ Continuous, Local Conditions			
Sampling Period 24 hour estimate	*every sample period*	*≥ 75% (18) of hourly averages*	1,2and 3) 40 CFR Part 50 App N Sec 3 (c) See additional details for sample periods less than 18 hours.
Hourly estimates	Every hour	Instrument dependent	See operators manual
Sampling Instrument			
Average Flow Rate	*every 24 hours of op*	*average within 5% of 16.67 liters/minute*	1, 2 and 3) Part 50 App L Sec 7.4.3.1
Variability in Flow Rate	*every 24 hours of op*	*CV ≤ 2%*	1, 2 and 3) 40 CFR Part 50, App.L Sec 7.4.3.2
One-point Flow Rate Verification	*1/mo*	*± 4% of transfer standard* ± 5% of flow rate design value	1, 2 and 3) 40 CFR Part 50, App.L, Sec 9.2.5, 40 CFR Part 58, Appendix A Sec 3.2.3 & 3.3.2
BAM Specific Critical Criteria			
Reference Membrane Span Foil Verification (BAM)	Hourly	± 4% of ABS Value	1,2 and 3) BAM 1020 Operation Manual
OPERATIONAL CRITERIA- $PM_{2.5}$ Continuous, Local Conditions			
Annual Multi-point Verifications/Calibrations			
Leak Check	every 30 days	**< 1.0 lpm BAM (Not Thermo BAMS)** **± 0.15 lpm TEOM**	1) 40 CFR Part 50 App L, Sec 7.4.6.1 2) Recommendation 3) BAM SOP Sec 10.1.2 TEOM SOP Sec 10.1.6 Thermo BAM leak check should not be attempted. Foils could be ruptured.
Temperature multi-point Verification/Calibration	on installation, then 1/yr	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
One-point Temp Verification	1/mo	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
Pressure Verification/Calibration	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 BP verified against independent standard verified against a lab primary standard that is certified NIST traceable 1/year

Reference

DEP 18-27
Revision No. 0
October 2015

STATEWIDE STANDARD OPERATING PROCEDURE

FOR
AIR MONITORING
DATA HANDLING AND DATA VALIDATION

State of Florida
Department of Environmental Protection
Office of Air Monitoring

Prepared By: Florida Primary Quality Assurance Organization

Approved By: _____ Date: _____
Quality Assurance Manager

Approved By: _____ Date: _____
EPA Region IV Approval Officer

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Questions?