OFFICE OF AIR QUALITY PLANNING AND STANDARDS

The QA EYE

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SPECIAL POINTS OF INTEREST:

- **Low level audits a concern. EPA will develop a Webinar Training Series (pg.6)**
- **NO_2 standards can replace IPN and NPN (pg. 4)**
- **Automated Assessments (pages 5-10)**

INSIDE THIS ISSUE:

Another Successful National Air Conference

Attendee numbers continued to grow for the National Ambient Air Conference in St Louis August 8 -11. The attendee tally topped out at 692 registered and 54 vendors. The weather was pleasant and we hope the sessions were of interest to all. As with our last conference in Atlanta, we incorporated the Air Quality System (AQS) conference into the Ambient Air Conference. Including AQS has been very helpful to the monitoring community and we plan to continue that cooperation in the future.

As is our normal mode of operation, Monday was devoted to training sessions. AQS training had a full day as well as our Quality Assurance training (QA-101). Half-day sessions included training on: PAMS Instruments, PAMS/CSN Data Validation, $PM_{2.5}$ Gravimeteric Labs, and Air Toxics. The QA-101 training session had the largest attendance. During the kick off to the training session we surveyed the audience and it appeared that about half were first time attendees to conference and many were "QA" personnel so that was equally exciting and beneficial. We look forward to any comments on QA-101 to help improve the content of this course.

The QA-101 training focused more on assessments this year and EPA Regions 1, 3 and 4 volunteered to discuss some of the techniques they use to assess data. Some of the techniques are Excel and R based and we hope to be able to make these available to monitoring organizations. More details on these automated assessment can be found on pages 5-9.

In addition to QA-101, we provided time for QA discussions at the two-hour Program Breakout Discussion Centers that occurred on Tuesday. The QA session was packed and although a number of topics were discussed, the session was mainly devoted to the ability of monitoring organizations to audit at low concentrations required in the new regulation promulgated on March 28, 2016. More information on this can be found on page 6.

The technical sessions on Wednesday included a half-day QA session with a number of great presentations. OAQPS had almost the whole Ambient Air QA Team at the conference and the side-bar conversations brought back a lot of good information and suggestions that we hope to incorporate in future guidance.

New QA Rules in Effect

On March 28, EPA published "Revisions to the Ambient Air Monitoring Quality Assurance and Other Requirements" (Vol 81 No. 59). The changes to the quality assurance requirements can be found in 40 CFR Part 58 Appendix A and Appendix B. It is suggested that you read this federal register in order to understand the changes to the quality assurance requirements and the rationale for them. The following provides the reader a brief highlight of the major changes to Appendix A. Not all changes are covered below and we have provided a summary of the changes on AMTIC that can be found at: https://www3.epa.gov/ttn/amtic/40cfr53.html

Changed the title of Appendix A to "Quality Assurance Requirements for Monitors used in Evaluations of National Ambient Air Quality Standards." This change is meant to highlight that the requirements apply to any monitor that is used for comparison to the NAAQS.

Continued on Page 2

New QA Rules in Effect (continued from Page 1)

Reformatted the pollutant sections- The previous regulation had separate sections for automated (continuous) and manual methods. Since some of the particulate matter methods are both continuous and manual and in some cases have different quality control requirements, monitoring organizations found the Appendix A requirements confusing. The four gaseous pollutants (CO, NO_2, SO_2 and O_3) are in one section since the quality control requirements are the same, and separate sections are provided for PM_{10}, $PM_{2.5}$ and Pb requirements.

Moved PSD Requirements to Appendix B - The combined regulations have caused some confusion and EPA moved the PSD requirements back to Appendix B. This also provides more flexibility for revision if changes in PSD requirements are needed.

PQAO Oversight - Since the PQAO can be a consolidation of a number of local monitoring organizations, the EPA added a sentence clarifying that the agency identified as the PQAO (usually the state agency) will be responsible for overseeing that the Appendix A requirements are being met by all consolidated monitoring organizations within the PQAO.

Removal of PM10-2.5 QA Requirements - EPA eliminated the $PM_{10\text{-}2.5}$ requirements in Appendix A to reduce burden. Similar to the CSN and PAMS networks, EPA will develop QA guidance for the $PM_{10\text{-}2.5}$ network which will afford more flexibility for change/revision.

QMP and QAPP submission and approval reporting to AQS - EPA requires that QMP and QAPP submission dates be reported to AQS by monitoring organizations and that QMP and QAPP approval dates be reported by EPA or the monitoring organization (if delegated self-approval). In addition, EPA added that if a PQAO or monitoring organization has been delegated authority to review and approve their QAPP, an electronic copy must be submitted to the EPA Region at the time it is submitted to the PQAO/monitoring organizations QAPP approving authority.

Revision of TSA Language to Cover Consolidated PQAOs - EPA revised the language to perform TSAs for each PQAO every three years and if a PQAO is made up of a number of monitoring organizations, all monitoring organizations within the PQAO should be audited within 6 years. This would allow EPA Regions to audit monitoring organizations within the PQAO.

Participation in AA-PGVP - EPA added the AA-PGVP annual survey requirement to Appendix A. In addition, EPA added language that monitoring organizations participate, at the request of EPA, in the AA-PGVP by sending a gas standard to one of the verification laboratories every 5 years.

1-Point QC Checks - EPA lowered the audit concentrations of the 1-point QC checks to 0.005 and 0.08 parts per million (ppm) for SO_2, NO_2, and O_3, and between 0.5 and 5 ppm for CO monitors and state that the QC check gas concentration selected within the prescribed range should be related to the monitoring objectives for the monitor (see rule).

Annual Performance Evaluation Audit Level Increase and Audit Level Selection Revision - EPA expanded the audit levels from five to ten and removed the requirement to audit three consecutive levels. One point must be within two to three times the method detection limit of the instruments within the PQAOs network, the second point will be less than or equal to the 99th percentile of the data at the site or the network of sites in the PQAO or the next highest audit concentration level. The third point can be around the primary NAAQS or the highest 3-year concentration at the site or the network of sites in the PQAO.

NPAP Description - EPA included NPAP requirements in appendix A.

Flow rate verification - EPA required flow rate verifications of all PM and Pb monitors/samplers be reported to AQS.

Reducing Pb cutoff values - EPA lowered the Pb cutoff to 0.002 $\mu g/m^3$ for methods approved after 3/04/2010 with the exception of manual equivalent method EQLA-0813-803, and will keep the 0.02 $\mu g/m^3$ cutoff value for methods approved before 3/04/2010 and manual equivalent method EQLA-0813-803. Quite a bit of collocated data and performance evaluation data collected is not used due to the previous Pb cutoff value (0.02 ug/m^3) . The new Pb method by ICP-MS, promulgated in 2013 in 40 CFR Part 50 Appendix G, showed that the MDLs were below 0.0002 $\mu g/m^3$ which is well below the EPA requirement of five percent of the previous Pb NAAQS or 0.0075 $\mu g/m^3$.

Technical Guidance Updates Since Last QA EYE

During the QA101 Training session at the National Conference, EPA was asked about technical guidance and how it can be used especially if it conflicts with something that may be described in the Code of Federal Regulations (CFR).

What is Technical Guidance?

In most cases, our technical guidance is either a more detailed interpretation of our regulations or something not covered in the regulation for which we are providing our best guidance. In the case where it describes something different than what is currently described in CFR then it is considered an acceptable alternative. An example of this is our guidance on calibrating monitors at a "calibration scale" that is at lower concentrations than some CFR methods that call for calibrating at the operating range of a particular method. By calibrating across the entire operating range, many calibration points are not close to where routine concentrations were being measured. By providing technical guidance to monitoring agencies to utilize a calibration scale, which is currently described in the 2013 QA Handbook, EPA provides an acceptable alternative approach to CFR. The technical guidance is not a requirement so some monitoring organization may choose to continue following the regulation.

There has been a number of technical guidance memos posted on AMTIC since the last QA EYE issue (Dec 2015). The following is a list of those memos related to our QA program and can be found at the Policy Memoranda and Technical Guidance site on AMTIC https://www3.epa.gov/ttn/amtic/ .

Use of $PM_{2.5}$ Field and Laboratory Requirements for Low Volume PM10 Monitoring to Support PM_{10} NAAQS (Posted 3/3/2016) - Use of PM_{10} low volume samplers, and the filter media used to collect these samples, is most similar to the field and laboratory $PM_{2.5}$ requirements in 40 CFR Part 50 Appendix L (since the PM_{10} samplers are basically $PM_{2.5}$ samplers with the second stage particle size seperator removed) and should be used in lieu of 40 CFR Part 50 Appendix J.

Technical Guidance on Annual PE Audit Levels Using Method Detection Limits (Posted 4/20/2016) - Due to the rule change on the selection of audit levels, EPA provided a memo describing how monitoring organizations can use Federal method detection limits (MDLs) listed in AQS or alternate methods detection limits that monitoring organization have developed and reported to AQS to identify the low audit level they must select for the annual performance evaluation. The selection of the audit level can be performed at the site level or the network level. In addition, the memo provides information on the statistics that can be used to identify the appropriate concentration for 1-point QC checks and the second annual PE audit level (99th percentile). The guidance also provided MDLs for all FRM/FEM methods currently listed in AQS as of the date of the memo.

Technical Guidance on the Use of Electronic Logbooks for Ambient Air Monitoring (Posted 4/20/2016) - The purpose of this guidance is to establish minimum requirements for documenting and maintaining electronic logbook (e-logbook) information for the Ambient Air Monitoring Program. This document is not intended to be inclusive of all electronic records initiatives presently being conducted in the EPA, but rather is seen as a starting point for an e-logbook practice to ensure some consistency across all the monitoring organizations utilizing e-logbooks for ambient air monitoring in accordance with 40 CFR Part 58.

Technical Note Related to PSD Monitoring Quality Assurance Activities (Posted 04/27/2016) - In May 1987, the EPA finalized a guidance document titled "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)," EPA-450/4-87-007. Over the past 25 years, significant advancements and changes have been made in the regulatory requirements for ambient air monitoring, not only for PSD but also for State and Local Air Monitoring Stations (SLAMS). Therefore, the 1987 PSD guidance document is outdated. In 2016, EPA had the opportunity to revise QA requirements and revised Appendix B. The technical note provides guidance in the form of questions and answers (Q&As) related to quality assurance activities for PSD monitoring organizations. It should be used as a resource for affected PSD monitoring organizations, their contractors, and State, Local, Tribal (SLT) and Federal agencies responsible for ensuring that the 40 CFR part 51 requirements are met. It is our intention to provide future updates to this technical note on an as needed basis.

Guidance on Statistics for Use of 1-Point QC Checks at Lower Concentrations (**posted 5/05/2016) -** Similar to the annual performance evaluation audits, EPA has provided "dual" acceptance criteria for one-point QC checks that are performed at lower concentration ranges. The acceptance criteria is as follows:

- O_3: $\pm$ 1.5 ppb difference or $\pm$ 7 percent difference, whichever is greater
- SO_2: $\pm$ 1.5 ppb difference or $\pm$ 10 percent difference, whichever is greater
- NO_2: $\pm$ 1.5 ppb difference or $\pm$ 15 percent difference, whichever is greater
- CO- NOTE: since the low end of CO one-point QC checks is 0.500 ppm, the absolute difference acceptance criteria that was developed for the annual PE (+ 0.03 ppm for concentrations <0.200 ppm) will not be in effect.

Minimum Negative Values for Gaseous Criteria Pollutants –(posted 10/6/2016)- We have developed one minimum acceptable negative value by parameter for each gaseous criteria pollutant rather than by each method code. See the AQS article on page 12 for additional information. as well as the technical note on AMTIC

Changes to the Ambient Air Protocol Gas Verification Program (AA-PGVP)

We are now in our sixth year of implementing the Ambient Air Protocol Gas Verification Program (AA-PGVP). Overall, the program has been a success. However, we have reached a point where monitoring organization participation has declined significantly.

The recently signed monitoring rule (published on 03-28-2016; effective 04-27-2016) contained two revisions that directly impact the AA-PGVP:

1. The required completion of an annual survey of the gas standards used by monitoring organizations in their program through the Battelle website. Completion of the survey will allow EPA to know which gas producers are used each year, and assist EPA in verifying a standard from each gas producer being used in the ambient air monitoring network.
2. The required monitoring organization participation in the program by sending one unused gas standard to one of the two regional air verification laboratories (RAVLs) once every 5 years. When the program was first implemented, monitoring organizations were allowed to volunteer to send standards to the RAVLs.

These revisions became necessary due to the a steady decline of participation in the program by the monitoring organizations; as a result of this decline, we were forced to ask the gas producers for standards. This approach defeats the intent of the program, which is getting a verification of a standard that is "blind" to the producer; meaning the producer is unaware that one of the standards they send to a monitoring organization is being used for additional verification. As a reminder, this program came about as a result of the Inspector General's assessment of EPA's oversight of gas standards used in the networks; and reaching the conclusion that more oversight was necessary (cylinder concentrations failed to meet established standards).

Over the course of the six years in which the AA-PGVP has been in existence, changes have been made to the program where AAMG now offers access to its shipping account to reduce the burden on monitoring organizations participating in the program. We also offer online DOT hazmat training required by UPS to ship gas cylinders; completion of this training certifies an individual for three years. As a final result, the monitoring organization gets a free verification of their gas standard.

On the gas producer's side, the RAVLS informed us that they were overwhelmed with gas producers asking for verification of standards from all of their manufacturing sites. As stated earlier, the intent of the AA-PGVP is to work with the monitoring organization, not the gas producers. We do not intend to continue to perform verifications of all producers' sites unless, through the survey results, we find that monitoring organizations are purchasing standards from every gas producer site.

With these revisions, and with the changes made in the program over the years, we hope to see greater participation by monitoring organizations in this program. We realize it is inconvenient to order a cylinder, then turn around and send it to the Region 7 or 2 RAVL for verification. But remember, cylinder concentrations had reached the point where monitoring organizations never knew what to expect when ordering cylinders. We hope those who have participated in the past will continue to participate or, if they have dropped out, will choose to start up again.

If monitoring organizations have not completed the survey this year, please complete it as soon as possible. It's now a requirement and will help us determine what standards we need to verify. A new survey will start in January 2017.

As for gas producers, if it is necessary to ask for standards from you, we will only ask for standards from sites monitoring organizations are using.

In addition to the potential use of NO_2 cylinders (see article below), there was a suggestion at the National Conference that the Ambient Air Protocol Gas verification program start testing NO_2 at lower concentrations. We'll be looking at what it might take to verify NO_2 cylinders at lower concentrations than are currently tested.

- Solomon Ricks

NO_2 Can Replace IPN and NPN for 1-point QC Checks for NO_Y Monitoring

Monitoring organizations have expressed come concern about our guidance on the use on iso-propyl nitrate (IPN) and N-propyl nitrate (NPN) compressed gaseous standards for quality control checks. QA EYE Issue 12 (page 8) and Issue 18 (page13) provided guidance on the use of IPN and NPN for the 1-point QC checks reported to AQS. As described in Issue 18, EPA-ORD-NERL was in the process of evaluating the merits of using NPN and IPN as a challenge agent for NO_Y (total oxides of nitrogen) analyzers compared to using NO_2 generated from GPT and certified cylinders.

Russel Long (ORD-National Exposure Research Laboratory) provided a presentation of their NO_2, NO_X and NO_Y Measurement Research at the 2016 Ambient Air National Conference during the Monday PAMS Training Session. They performed a series of laboratory studies evaluating the various calibration/challenge techniques using NO_2 compressed gas standards, NO_2 by GPT, IPN, and NPN, and concluded that regardless of the calibration/challenge method, very similar results were obtained in instrument response. Dr. Long's presentation will be posted, along with the other Monitoring Conference presentations, on AMTIC at: https://www3.epa.gov/ttn/amtic/naamc.html. Based on ORDs research, EPA will accept the use of NO_2 compressed gas standards and NO_2 by GPT for NO_Y 1-point QC checks. This information will also be included in the PAMS Technical Assistance Document (TAD) that is currently under revision.

Annual Box and Whisker Plot Now Available Any Time

Since 2004 EPA has been generating some form of box and whisker plot for the gaseous criteria pollutants to provide a graphical presentation of annual data for each monitor in a PQAO. The plots are generated using the 1-point QC data that is collected minimally every 14 days. The plots have been very useful because they allow one to compare all sites within a PQAO and identify particular sites that may need "data quality" attention. However, EPA was only able to generate the report once a year which was then posted to AMTIC. We have now redeveloped the tool and posted it to AirData. Its look is also a little different from past reports.

Generating the Report

Go to the following website https://www.epa.gov/outdoor-air-quality-data. Select "Single Point Precision and Bias Report" (Figure 1) from which you can select the individual gaseous criteria pollutants or all four. You can then select a year and one of three domains: 1) an EPA Region, 2) a State or, 3) A PQAO. There are "bounds for graph" but that will be discussed shortly. Once you've made your selection select "Plot Data."

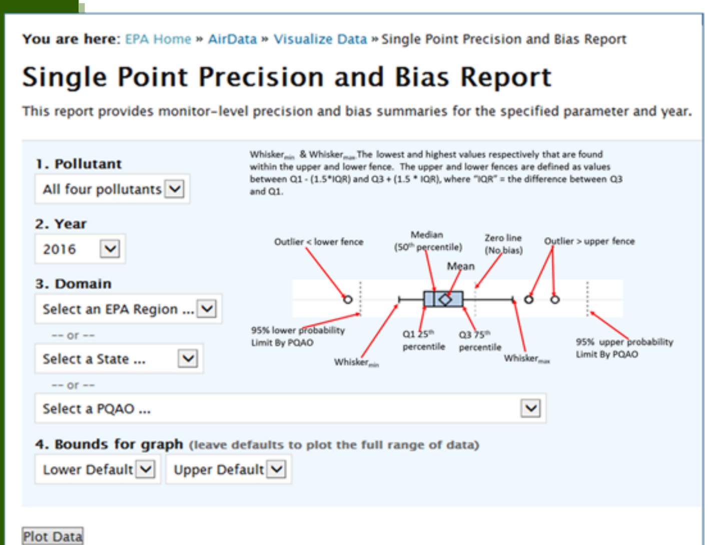


Fig 1. Selection Criteria for Box and Whisker Plots

Components of the Graphs

Each graph presented is comprised of four parts, which are discussed in the following sections. The four parts of each graph are as follows:

- Data Grouping
- Supplemental Statistics
- Box and Whisker Plots
- 95% CFR Confidence Limits

Figure 2 illustrates how these different components appear within each graph.

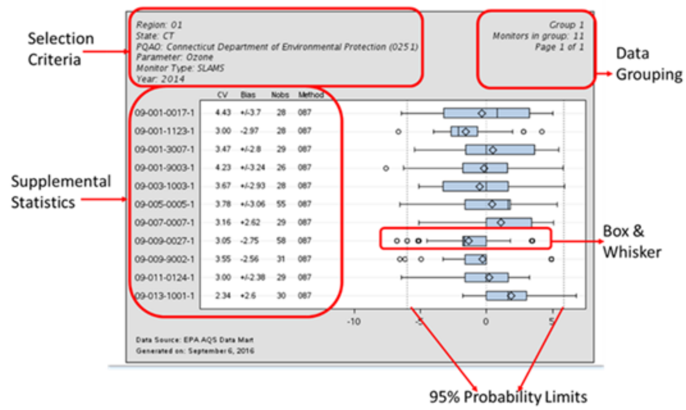


Figure 2. Components of Box and Whisker Plots

Data Grouping (upper right hand corner)

Each page of the report displays the results for a particular data grouping. A "data grouping" is defined by unique combinations of Domain (Region or State or PQAO) and Monitor Type Classification. However, once the report is generated, the data is output by PQAO and monitor type classification. For example, if one chose a state that had four PQAOs with a SLAMs monitor type classification and two of those PQAOs also had an "SPM" monitor type classification, the evaluation would display a total of 6 groupings. Each report identifies the number of monitors in that group as well as the number of pages in the group. If a PQAO has more than 12 monitors measuring the same pollutant for the same monitor type category, the graphs will appear on multiple pages.

Supplemental Statistics

In addition to the statistics represented in the box and whisker, the following information and statistics are displayed for each monitor within each data grouping:

- AQS ID – The plots are sorted by the AQS ID.
- CV Upper Bound
- Bias Upper Bound
- # Obs - Number of Samples contained within the set
- Method Designation

The information displayed in this area of the plots would also be found in the AMP256 Report. *(continued on Page 6)*

Box and Whisker Plot *Continued from page 5*

Box and Whisker Plots

A "Box and Whisker Plot" is created for each monitor within a PQAO measuring a gaseous criteria pollutant (CO, NO_2, O_3, and SO_2). A single box plot is based on the percent relative error statistics from the one-point precision checks for a single monitoring site measuring a pollutant conducted within the effective time period. Multiple box plots are displayed within a data grouping. A box plot displays the following statistics:

- Q3 (75th Percentile)
- Q2 (50th Percentile) - Median
- Q1 (25th Percentile)
- Arithmetic Mean
- $Whisker_{min}$ & $Whisker_{max}$ The lowest and highest values respectively that are found within the upper and lower fence. The upper and lower fences are defined as values between Q1 - (1.5*IQR) and Q3 + (1.5 * IQR), where "IQR" = the difference between Q3 and Q1.
- Outliers: All values that fall outside (above or below) the upper and lower fences.

The Bounds for Graph Selection

Since outliers are displayed, they dictate how the box and whisker plots are generated. A single large outlier can make the plots virtually unreadable. However, they can help to identify possible errors in data entry or data that should have been invalidated. An example of this follows.

Figure 3 represents a plot with the bound of the graph at default (all outliers shown). The -100% difference for one QC check dictates the size of the box and whisker for the group. It is suggested that the plots initially be reviewed in default mode to identify outliers for potential correction action. Figure 4 is the same set of data with the bounds set to +10% and -10%.

A big thanks goes out to Jon Miller and Nick Mangus from the National Air Data Group for the initial development and annual reporting of the box and whisker plots and to David Mintz on the Air Quality Analysis Group for modifying it and getting it on to Air Data.

Figure 3. Plots with default

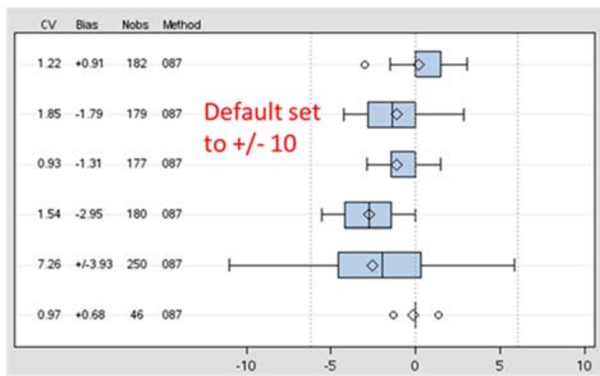


Figure 4 with defaults set to ± 10%

Low Level Audit Concentrations Remain a Concern for Monitoring Organizations

Of the changes to the March 28 QA regulation "Revisions to the Ambient Air Monitoring Quality Assurance and Other Requirements" (Vol 81 No. 59), the one that remains of most concern to monitoring organizations is the Annual PE Audit Levels. The Appendix A language on the audit concentrations follow:

3.1.2.1 The evaluation is made by challenging the monitor with audit gas standards of known concentration from at least three audit levels. One point must be within two to three times the method detection limit of the instruments within the PQAOs network, the second point will be less than or equal to the 99th percentile of the data at the site or the network of sites in the PQAO or the next highest audit concentration level. The third point can be around the primary NAAQS or the highest 3-year concentration at the site or the network of sites in the PQAO.

This requirement was a compromise based on comments received on the rule where we had initially proposed that two of the audits levels selected should represent 10 - 80 percent of routine ambient concentrations measured by the monitor or in the PQAOs network of monitors and the third point should be at the NAAQS or above the highest 3-year routine concentration, whichever is greater.

The rule revision was meant to allow monitoring organizations to select two audit concentrations that represented 99% of the data in their network while still allowing for an audit level to represent the accuracy of the monitor around the level of the NAAQS. The concern continues to be selecting the point around the audit levels 1 and 2.

(continued on page 11)

Region 3's 504 QC Data Review Tool

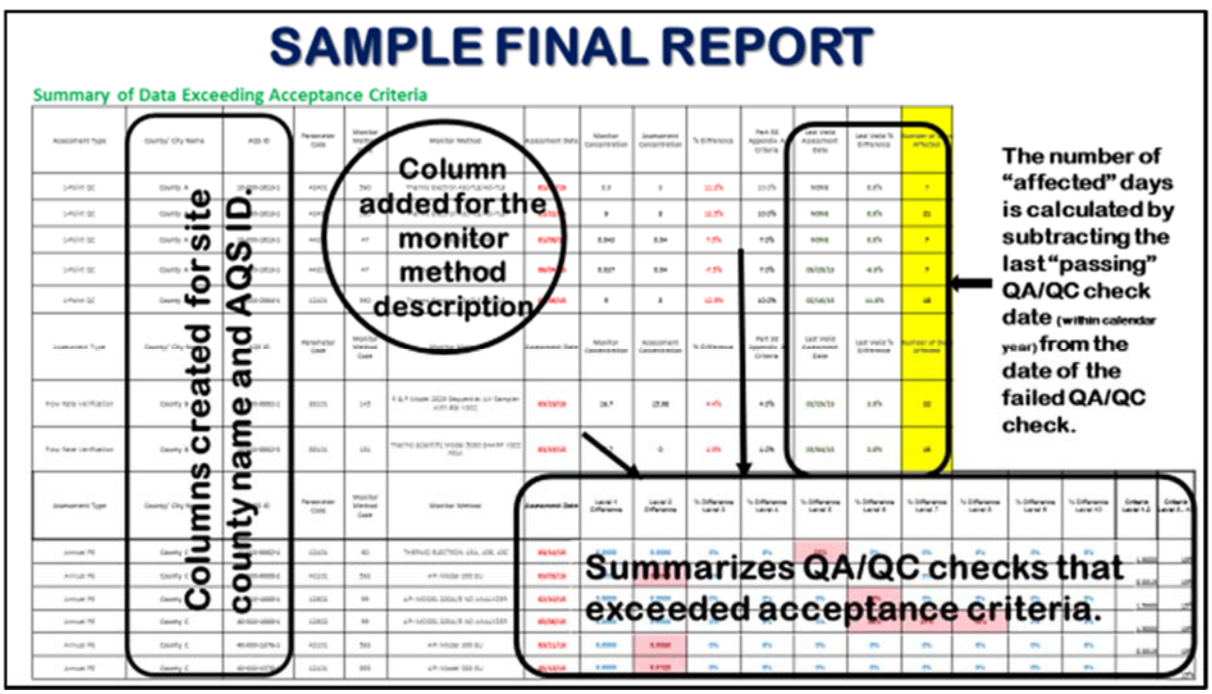
It all started as a pre-audit activity for Region 3's Technical Systems Audits (TSA). In an effort to identify *invalid* or *questionable* data submitted to AQS, R3 auditors began reviewing QC data in the AMP 504 report. It was simple task – (1) retrieve the QC data; (2) identify any exceedances of critical acceptance criteria from the validation templates and (3) inform the agency of our findings. As with most things in life, nothing is ever simple or easy, we grossly underestimated the amount of time it would take to manually analyze, format, and sort through years of QC data. The process took weeks to complete. Argh! Until one day, the proverbial lightbulb went off in the mind of one of our staff members (Jim Smith) to automate my excel spreadsheet. Eureka! In what took us weeks to do Jim's version accomplished in mere minutes. We quickly realized our in-house tool could be useful to others who review and submit QC data to AQS.

Now more than ever ambient air monitoring data has been under tremendous scrutiny regarding its use, validity and defensibility in regulatory decisions. The spotlight on data quality (i.e. data verification, data validation and quality assurance) continues to take center stage in many of our discussions, objectives and monitoring activities. Development of automated tools for conducting comprehensive and efficient data reviews are sorely needed in our QA programs.

In August 2016, we demoed the 504 automated excel report during the *QA-101 Workshop* at the National Air Monitoring Conference. The 504 tool aids QA staff in reviewing QC data via the 504 Extract QA Data Report. The beauty of the tool is that it works for those who submit data to AQS and for those who review data in AQS. Monitoring agencies can run the tool before uploading QC data to AQS as a final data verification and data validation check. EPA Regional TSA auditors can use it as part of their data review process. The 504 tool:

- Converts 504 text file to an excel file and automatically saves it as a separate file.
- Organizes data, adds worksheets and additional information to the file.
- Sorts through data and identifies exceedances based on the criteria from Validation Templates
- Produces a final report

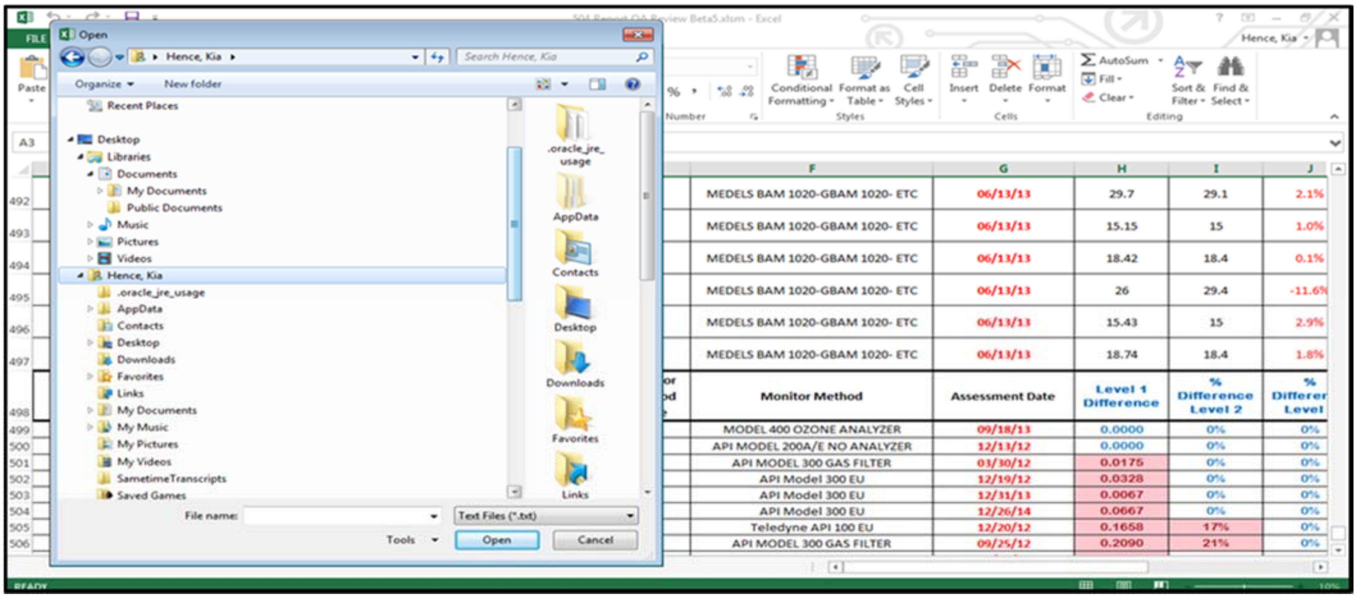
Continued on page 8



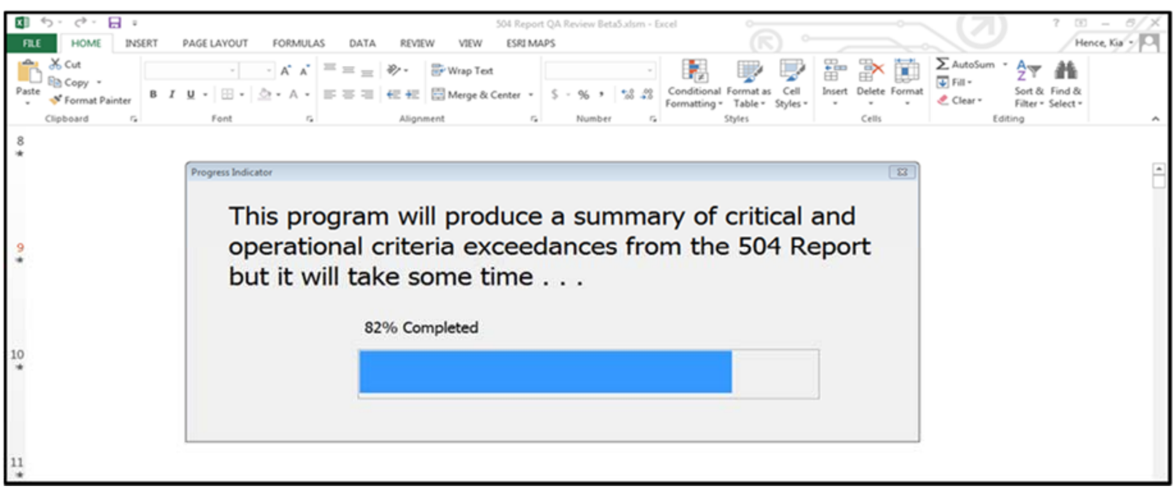
Region 3's 504 QC Data Review Tool (*Continued from Page 7*)

Directions

1. Download and save an AMP504 text file from AQS or save the text file generated from the QA transaction generator.
2. Open the 504 Excel tool. (Note: You may need to select "Enable Content" for the program to run.) A window will pop up prompting you to select a 504 text file.



3. Coffee time! Go grab a cup of coffee while the report runs.
4. Finally, once the report is finished loading. A window will appear asking if you want to process another file. Select "Yes" if you want to run another 504 text file. If not, select "No".



The 504 QC Tool is under final review and will be posted on AMTIC by the end of the year - *Kia Hence EPA Region 3*

Region 4 is using R for Data Quality Assessments

During the QA-101 Training at the 2016 National Ambient Air Monitoring Conference, EPA Region 4 provided a demonstration of an automated data quality assessment tool. Over the past several months, EPA Region 4 SESD has evaluated the R programming language for its effectiveness in use for performing automated data quality assessments. Three data quality assessment tools have been developed to date as demonstration projects. Two of these assessment tools include a Data Completeness Report and a PQAO-centric Network Summary Report that use R programs to directly connect to the Oracle tables in AQS and then export the summarized data results into formatted Excel™ spreadsheets.

In addition to identifying quarters and years where low data capture have occurred, the Data Completeness assessment tool detects NAAQS Excluded monitors, and also highlights criteria analyzers that are not reporting required non-criteria parameters (i.e., detects NO & NO_X channels not reported from NO_2 analyzers and detects when 5-minute SO_2 measurements are not reported from SO_2 analyzers).

Automated Data Completeness Assessment

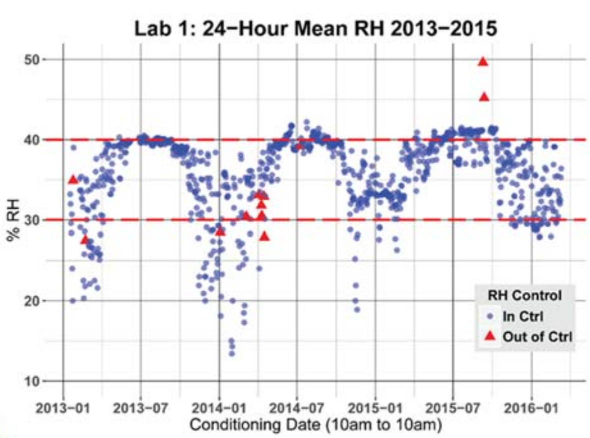
R Program Connecting Directly to AQS Oracle Tables, then Exporting to Excel

Query Date: 2016-03-29							2013					2014				
AQS Site	Param	Name	POC	Dur	Monitor Type	Network	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Annual	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Annual
	88502	PM2.5-AQI	3	X	SLAMS	--	--	--	--	--	--	--	--	--	66	20
	44201	O3	1	W	SPM	--	--	96	99	100	98	--	82	99	100	93
	44201	O3	1	W	SLAMS	--	--	93	99	97	95	--	77	90	94	85
	42401	SO2	1	Y	SLAMS	--	87	99	99	99	96	99	99	98	99	99
	42401	SO2M	3	H	SLAMS	--	--	--	--	--	--	--	--	97	96	49
	42602	NO2	2	1	SPM	--	88	99	99	99	96	88	99	99	99	96
	81102	PM10	3	X	SLAMS	--	99	99	90	100	97	100	100	100	100	100
	42401	SO2	2	1	SPM	--	99	99	99	97	98	98	99	38	98	83
	42401	SO2	2	Y	SPM	--	98	99	99	96	98	97	99	37	97	82
	42401	SO2M	5	H	SPM	--	--	--	--	--	--	--	--	37	96	33
	42602	NO2	1	1	SPM	--	66	65	99	78	77	91	77	72	95	84
	44201	O3	1	W	SLAMS	--	--	99	82	97	91	--	84	99	97	92

LEGEND
- 75% to 79% Data Completeness
- 0% to 74% Data Completeness
- Missing Required Non-NAAQS Parameter
- NAAQS Exclusion

Input Query	
Start YR	2013
End YR:	2014
PQAO:	
State:	
County:	
Region:	04

Another data quality assessment tool developed by Region 4 examines the diagnostic health of $PM_{2.5}$ gravimetric laboratories via their filter conditioning performance. Several air monitoring programs operate $PM_{2.5}$ gravimetric laboratories in Region 4. TSAs in recent years have found QA/QC concerns at some of these labs. At the time of these TSAs, the EPA Region 4 auditors did not have data visualization tools to assist in diagnosing the performance of the lab's filter conditioning processes. TSA auditors had to rely on manually spot checking records which is time intensive and does not provide a comprehensive conceptual QA model of the laboratory's performance. To address this deficiency, EPA Region 4 staff developed a visualization tool using the R programming language. The figure below illustrates the effectiveness of R for visualizing and analyzing very large datasets efficiently and quickly. The assessment tool imports RH and temperature minute readings stored in CSV, Tab Delimited, or MS Access™ file formats. These data are automatically reduced and summarized by the data quality assessment tool into 24-hr means and standard deviations that can be compared to 40 CFR Part 50 Appendix L method requirements. The R program used for this control chart was found to be easily adaptable to evaluate data generated from multiple proprietary laboratory formats.



With decreasing resources and increasing demands being placed on local, state, tribal, and federal governments, improving the efficiency and effectiveness of data quality assessments is becoming ever more critical to performing routine data quality assessments and for conducting successful TSAs. Automated data analysis tools serve to drive consistency in data evaluations, enhance the speed in performing data reviews, and liberate limited staffing resources for other high value activities in the audit. Looking forward, as more R tools become developed and standardized, it is hoped that these data quality assessment tools can also be exported to air monitoring programs beyond just EPA. Due to interest expressed by attendees at the 2016 National Ambient Air Monitoring Conference, EPA has already begun to investigate solutions such as web based Dash Board interfaces coded in R-Shiny or SharePoint file storage systems for possible delivery solutions to allow access to tools such as these for State, Tribal, and Local air monitoring programs. - *Doug Jager EPA Region 4*

Got PM2.5 Filters Sticking to the Screen?

We've heard from $PM_{2.5}$ laboratory analysts and through TSAs about a problem where Teflon filters "stick" to the stainless steel backing screens. This, of course, is a problem because there is a potential of biasing data by leaving filter mass on the screen or transferring mass to the filter from the screen. Several theories have been presented to explain why the filters sometimes stick to the screens, but there has not been any evidence supporting any theory, until now. The Southwest Ohio Air Quality Agency, had several instances of a sticking screen and decided to investigate. The filter itself was typical, no noticeable differences from other filters, but the screen had a brownish residue around the edge. The residue was very difficult to remove and in some cases could not be removed with washing, sonicating or other methods. Many have speculated that the screens rust over time which would explain the brown residue, but no firm data supported the theory. The screen pictured was sent to the Hamilton County, Ohio crime lab for analysis using Scanning Electron Microscopy, and the residue was described as "consistent with rust." We cannot say that every instance of sticking filters can be attributed to rust; however, it does confirm that the screens have a limit on their usefulness for monitoring. This limit may depend on several factors including composition of PM collected, proximity to salt water, and cleaning method to name a few, so it would be difficult to put a time frame for replacement of the backing screens. Therefore, a best practice would be for filter weighing analysts to closely examine the screens - quarterly at a minimum. Screens that show discoloration should be discarded and replaced. Screens can be purchased through the manufacturers for approximately \$5.00-\$10.00 based on screen type if ordered in bulk.

Why is this important? Our ambient concentrations keep falling as well as our NAAQS. Small amounts of bias add uncertainty to our measurements, especially at low concentrations. Rust deposited on the filters or filter pieces left on the cassettes bias weighing data and are not representative of the ambient air being monitored. The bias can be easily eliminated by examining the backing screens and replacing as necessary. Rusty screens are by no means the only reason that filters may stick to the backing screens. Residue from cleaning solutions and vacuum grease from samplers could also contribute, but this is a check every PM weighing lab should implement. – *Anna Kelley, Southwest Ohio Air Quality Agency and Greg Noah, OAQPS*

New PAMS Required Network QA Program Moving Forward

On October 1, 2015, EPA revised the implementation of the PAMS program. With that revision came a shift to implementing PAMS at a "Required Network" of about 40 sites and then an "Enhanced Monitoring Program" network which provides monitoring agencies more flexibility on what to monitor. The Required Network must be operational by June 1, 2019. While this seems like plenty of time, a lot needs to be done between now and June 2019. The Required Network includes:

VOC measurements - hourly (suggested) speciated with auto-gas chromatographs (GCs) with a waiver option for three 8-hour samples every third day;

Carbonyls - with a frequency of three 8-hour samples on a one-in-three day basis using the TO-11A method;

NO, NO_Y and true NO_2 - where the latter must be measured with a direct reading NO_2 analyzer, cavity attenuated phase shift (CAPS) spectroscopy, or photolytic-converter NO_X analyzer; and

Meteorology Measurements - All Required PAMS sites must measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height.

Following the promulgated changes, EPA felt that that it was necessary to review the PAMS quality assurance program and tailor it to the needs of the Required Network. With that in mind, we developed the PAMS QA Implementation Plan (QAIP). The QAIP describes the monitoring requirements; the PAMS quality system (QS); the necessary QS actions, the schedule for these actions, and the individuals/parties responsible for implementing the QS for the PAMS Required Network sites.

EPA has developed a PAMS Workgroup made up of OAQPS PAMS Leads, EPA Regional PAMS points of contact, and points of contact from each monitoring agency required to implement a Required site. EPA started meeting internally with the EPA Regions on this project in late 2015 and then invited the monitoring organizations to participate and comment on the first draft QAIP. We have had monthly conference calls since May, 2016 to discuss the QAIP as well as other PAMS program activities.

The QAIP will be finalized in October 2016 and posted on AMTIC. More detailed documents will be forthcoming, to include a PAMS Technical Assistance Document (TAD), a generic QAPP, and SOPs for the auto-GCs ceilometers, and direct NO_2 methods. Proficiency test programs and training programs on some of the methods will also be developed with the 2017 to 2019 time period and are all identified in the QAIP .

Low Level Audit Concentrations *(Continued from page 6)*

During the national conference we listened to a number of concerns which included:

1. A monitoring organization that has purchased trace gas instruments but may not have the equipment, or the resources to purchase the equipment, to audit the instruments and may end up pulling out older monitors with higher MDLs in order to audit at higher concentrations.
2. A monitoring organization that is currently capable of auditing two to three times the MDL (since it has a high MDL) may not be able to audit at less than or equal to the 99th percentile of the data (2nd audit level), since their data is lower than two to three times the MDL of the instrument.

In the first instance, it would be unfortunate to moth ball trace gas equipment due to the instruments having more sensitive MDLs when: 1) the concentrations justify it and 2) monitoring organization should have the resources to be able to calibrate and audit the trace gas equipment they've purchased. In the second case it would seem that if 99% of the routine concentrations are below two to three times the instruments MDL one would want to acquire the monitors necessary to measure those concentrations.

EPA has also received comments, during promulgation of the rule and afterward, that our monitoring networks have been set up to ensure attainment of the NAAQS standards and therefore we should be auditing at NAAQS levels. Our regulations provide for 1-point QC to be selected at higher concentrations, cognizant of the monitoring objectives and the NAAQS, with one of the Annual PE points to be selected around the primary NAAQS, and the span point (performed every two weeks) to be at around 80% of the calibration scale. All three of these points provide the ability to evaluate and ensure data quality around the NAAQS. To include two points at concentration ranges where most of the data are reported at each site once a year does not appear to be unreasonable especially since most states have an NCore site with the requisite equipment to perform low level calibrations and audits.

As the data on page 16 illustrates, thanks to all our hard work, pollutant concentrations are now much lower. The data we collect throughout the network is required for making NAAQS determinations, but it also has several other uses by EPA and other stakeholders. For this reason, the quality of the data at these low levels is important. So, the mindset of monitoring and auditing needs to change to accommodate these lower concentrations. In the past, we have used terms like "trace level" and "full-scale" to describe what levels we use to monitor. With the current low concentrations, all monitoring and audits are essentially "trace level". This requires us to pay closer attention to details in our processes such as probe cleanliness, tank gas quality, and gas blender calibrations to produce quality data.

Due to these low levels, some concerns have been expressed about resources needed to meet the audit requirements. EPA regions may also be looking at sites that typically measure low concentrations to determine their usefulness and their potential for shut down. This may be considered for sites where there is not a regulatory mandate to keep them running, and monitoring organizations don't have plans to invest in the equipment necessary to ensure data quality at the low levels.

For the past few years, the EPA National Performance Audit Program (NPAP) community has been developing procedures and exploring equipment requirements to audit the NCore monitors. The NPAP community has determined that the low levels can be successfully and consistently audited using updated equipment and utilizing enhancements to the current procedure. Avi Teitz (Region 2), Chris St. Germain (Region 1), and other NPAP coordinators have developed general specifications for equipment that have proven to meet the needs of the low level auditor. Of particular interest is the work done identifying general specifications for the gas blender and tank gas concentrations. Those specifications are listed in Figure 1.

Continued on page 12

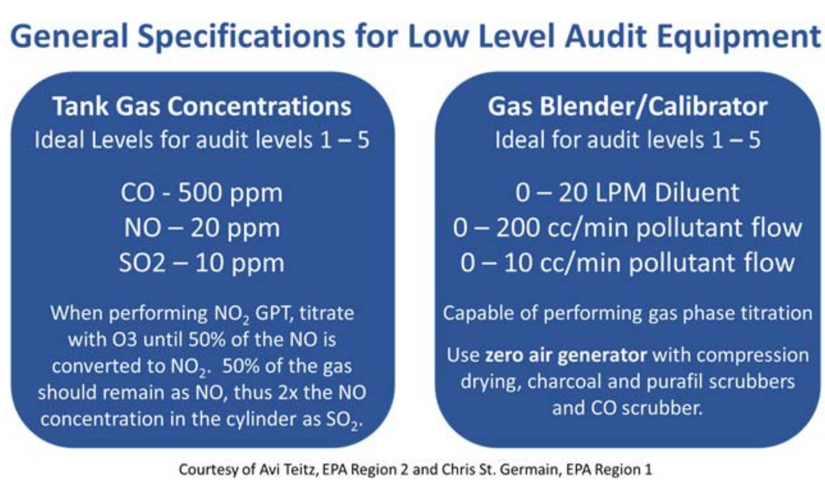


Figure 1.

Low Level Audit Concentrations

(Continued from page 11)

While these specifications are general and do not cover all operational requirements of a gas blender, they do identify key elements that are necessary to audit at the low levels. An auditor should be able to reference these specifications when procuring new equipment acceptable for low level audits or use them to potentially upgrade existing equipment.

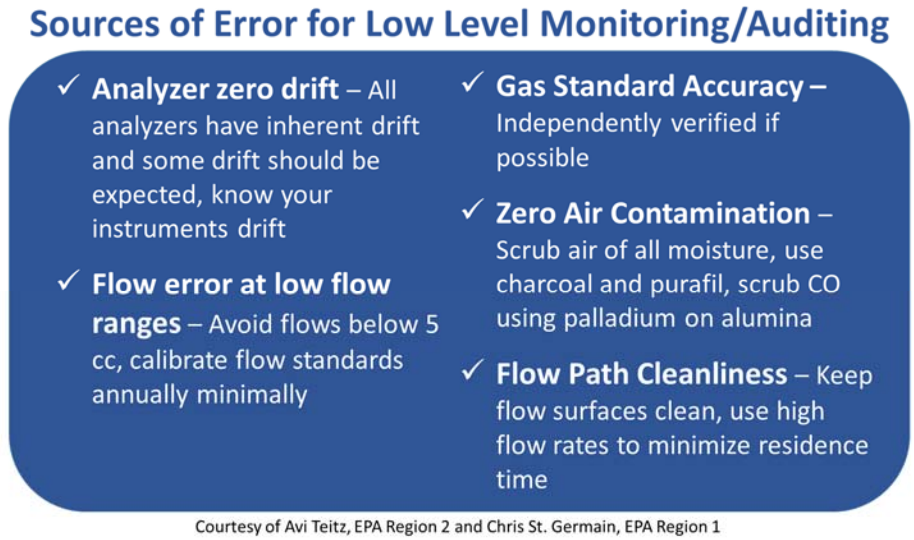


Figure 2

There are several potential sources of error that can have a large effect on low level auditing that have minimal affect at higher concentrations. Issues such as analyzer drift, flow errors, and zero air quality can greatly affect the precision of the audit at low levels. The major sources of error are described in Figure 2. Overall, these low level systems require more attention to maintenance and performance than monitors set to measure at "full scale". Operators and auditors alike must understand the potential issues and be proactive in controlling them.

Webinars on Auditing

We understand that auditing at these low levels is a challenge; however it has been proven to be feasible and is ultimately required and necessary to assess the quality of the data at the present ambient levels. While this information provides a general overview of the low level audit process, it does not cover all that we have learned regarding low level auditing.

So to assist monitoring organizations in performing low level audits, we will be offering webinars to provide more detail on our experience and give auditors the opportunity to ask technical questions.

We expect to conduct the webinars several times over the next month or two to give as much opportunity as we can for participation. We strongly encourage auditors to attend the webinar and ask questions. Your experience is instrumental in fine tuning and enhancing the process.

Some AQS Related Changes Coming in the Near Future

There are a number of AQS topics we are pursuing.

Difference statistics for low concentration 1-point QC checks

On May 5, 2016, EPA distribute an guidance memo on AMTIC that provided for "dual" acceptance criteria for one-point QC checks that are performed at lower concentration ranges. These acceptance limits conform to the acceptance limits developed for the audit levels 1 and 2 (Technical Memo posted on AMTIC on 2/17/2011)

O_3: $\pm$ 1.5 ppb difference or $\pm$ 7 percent difference, whichever is greater
SO_2: $\pm$ 1.5 ppb difference or $\pm$ 10 percent difference, whichever is greater
NO_2: $\pm$ 1.5 ppb difference or $\pm$ 15% percent difference, whichever is greater
CO- NOTE: since the low end of CO one-point QC checks is 0.500 ppm, the absolute difference acceptance criteria that was developed for the annual PE (+ 0.03 ppm for concentrations <0.200 ppm) will not be in effect.

Our AMP256 and 600 reports will have to accommodate the new criteria.

Adding Zero and Span QA Transaction-

During the QA-101 training session at the National Conference we had a few monitoring organization ask for the development of QA Transactions for the zero and span checks. In talking with the AQS Team, it did not appear difficult to accommodate these transactions. They will not be mandatory to report but we'll also have to accommodate evaluations of the data in future AMP256 reports which may take some time.

Negative Value for Gaseous Pollutants-

EPA has received requests to expand the reporting of negative values for some gaseous criteria pollutants. Rather than base an acceptable negative value on Federal Method Detection Limits (Fed-MDLs) posted on AMTIC for each method, EPA will base the negative value at the parameter level and use the following values for all the gaseous criteria pollutants.

- SO_2 and O_3: -4.0 ppb
- NO_2: -5.0 ppb
- CO: -0.4 ppm

AQS will make changes at the beginning of the new year. A technical note has been posted on AMTIC that provides more details. https://www3.epa.gov/ttn/amtic/cpreldoc.html

The Performance Evaluation Program (PEP) Bias: An Enigma of Our Success in Reducing $PM_{2.5}$ Concentrations

Part 1: The loss of interesting (useful?) PEP data at ambient concentrations near and below 3 µg/m³.

The EPA's $PM_{2.5}$ Performance Evaluation Program (PEP) results exhibit an increasing trend in measured ambient $PM_{2.5}$ concentrations of 3 µg/m³ or less. 40 CFR Part 58 appendix A states that for $PM_{2.5}$, "a valid performance evaluation audit means that both the primary monitor and PEP audit concentrations are valid and above 3 µg/m³." Consequently, the EPA's Air Quality System will not include paired measurements where one or both values are $\leq$ 3 µg/m³ in the calculation of bias for the AMP 256 Data Quality Indicator Report and the AMP 600 Data Certification Report. Under the current regulations, with the trend of improving air quality across the US, we have to dramatically increase the number of data pairs that are collected in order to get the required number of audits to be in the bias calculations. Otherwise we weaken the confidence in the annual bias determination at any level of aggregation. Might other alternatives exist?

The $PM_{2.5}$ PEP has produced about 950 measurements per year since 2007, shown in Figure 1. For the purpose of quantifying the incidence of low concentrations we included in this number the PEP's internal precision studies measurements, in which 3 to 8 of each region's PEP samplers semiannually are run in a cluster, simultaneously, over two to three days.

Figure 2 illustrates the number of PEP sampling events (from 2007 through the first half of 2016) whose $PM_{2.5}$ measurements have been excluded from the bias assessment due to the 3 µg/m³ cut-off over time. Region 8 dominates the contributions of PEP results that are
3 µg/m³ or less; however Regions 1, 9 and 10's contributions are also significant. Note only a partial year of data are included for 2016.

Figure 3 includes SLT measurements of $\leq$ 3 µg/m³, which makes the trend even more obvious. The blue line, "total count," of measurements again reflects only the first half of 2016, but the percentage of concentrations ≤ 3 µg/m³ is rather dramatic.

The national air data trends through the end of 2015, shown in Figure 4 (next page), suggests that we might see even more concentration measurements that fall below the 3 µg/m³ threshold. (Notice nearly 90% of the nation's measurements taken at trends sites have fallen below 10 µg/m³. More implications of this phenomenon will be covered in Part II).

Figure 1. Number of PEP Filters with $PM_{2.5}$ Measurements by Region (2007 - 2016)

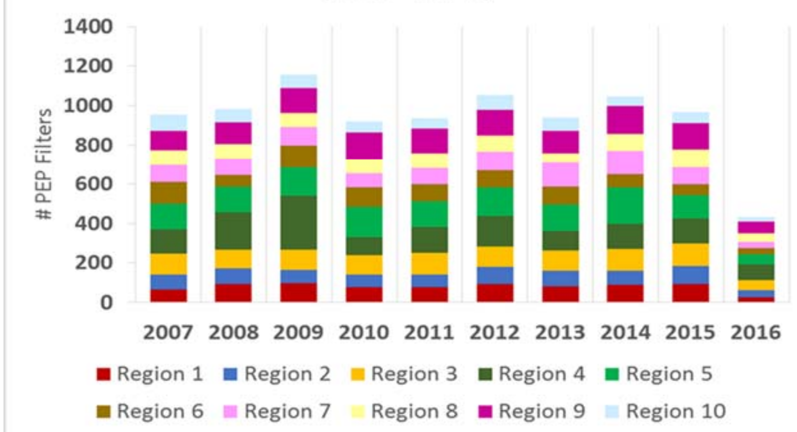


Figure 2. Number of PEP Filters for which $PM_{2.5}$ Measurements Were Below 3 µg/m³, by Region (2007 - 2016)

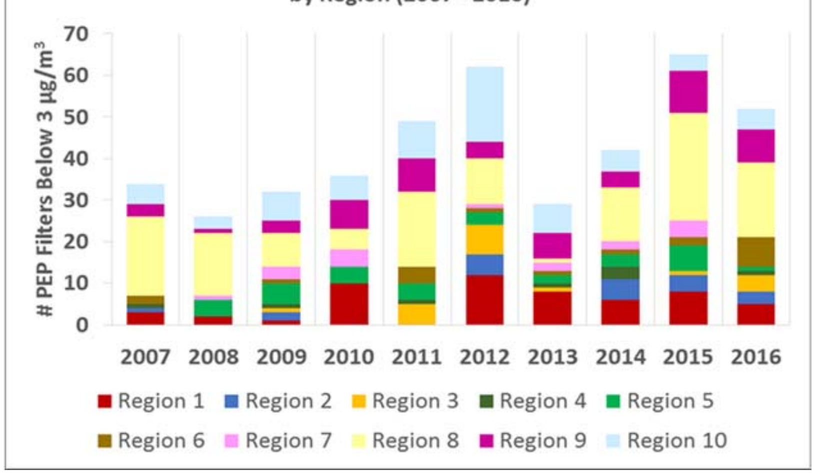
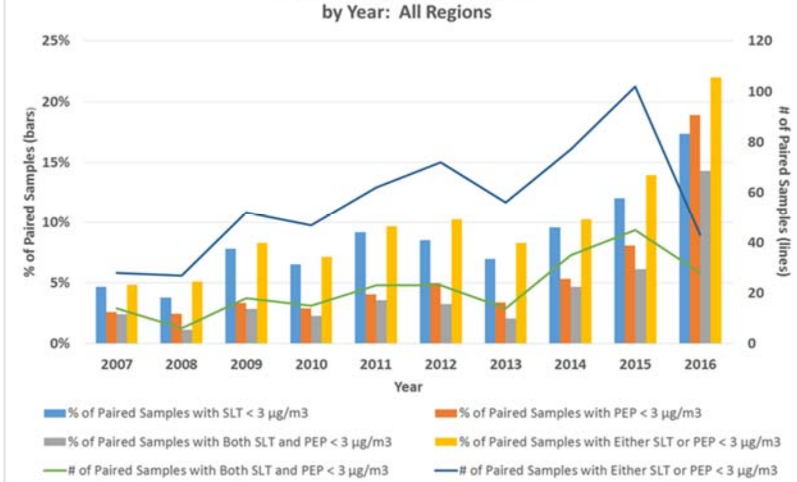


Figure 3. Paired SLT and PEP Samples with $PM_{2.5}$ Concentrations < 3 µg/m³, by Year: All Regions



The Performance Evaluation Program (PEP) Bias *(Continued from page 13)*

Figure 5 is a scatter plot of the data pairs that have been set aside due to one or both of the pair being 3 µg/m^3 or less. We noticed an interesting characteristic: 84% of these data pairs have an absolute difference between the individual values that are within 1 µg/m^3 of each other.

The average and median SLT sample bias are -0.44 µg/m^3 and -0.40 µg/m^3, respectively, but most importantly, the standard deviation is 0.57 µg/m^3.

Consequently we took a close look at our PEP field blank data to characterize our programmatic detection limit in order to get a better sense of the lower concentration limit at which bias may be reliably measured. Notice in Figure 6 that from August 2011 through May 2016 our average mass contamination is ≈ 5 µg per filter and remarkably constant.

As is shown in Figure 7, using the convention of adding 3 standard deviations to the average and converting mass per filter to concentration, the PEP FRM "method lower detection limit" is 0.8 µg/m^3.

We believe these characteristics may provide some avenue to use low concentration data for bias. In the next article "Part II: The effect on bias when a majority of measured concentrations fall below 10 µg/m^3," we will examine how the current equations in 40 CFR Part 58 Appendix A are posing another challenge to meeting the prescribed data quality objective at the PQAO level of aggregation. We will also examine the absolute difference approach for measurements between 3 µg/m^3 and 10 µg/m^3. *- Dennis Crumpler*

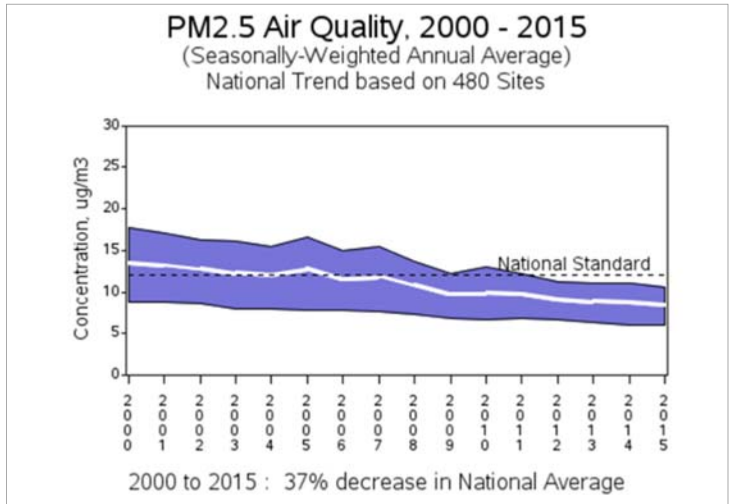


Figure 4. Steady decline in ambient PM2.5 concentrations.

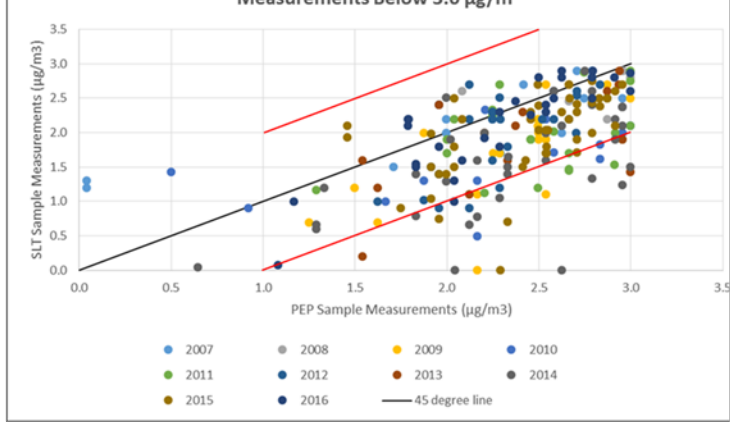


Figure 5. Paired SLT and PEP Samples with Both $PM_{2.5}$ Measurements Below 3.0 µg/m^3

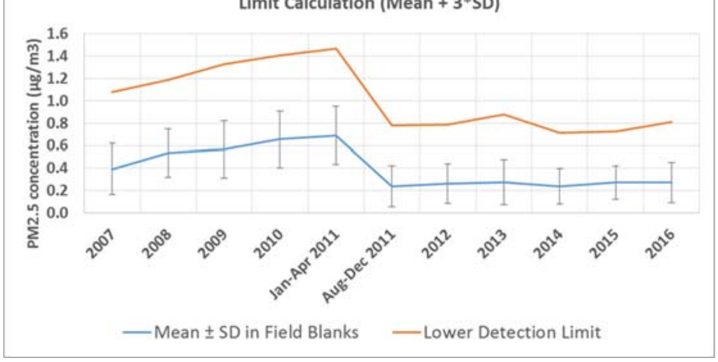


Figure 7. Annual Mean Air-Equivalent $PM_{2.5}$ Conc. for Field Blanks (±SD), and Lower Programmatic Detection Limit Calculation (Mean + 3*SD)

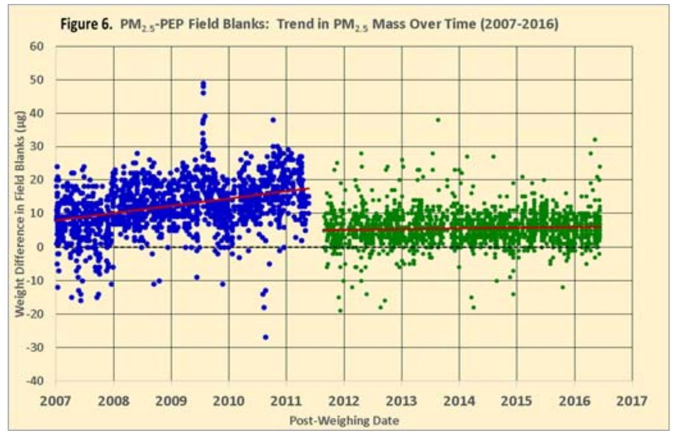


Figure 6. $PM_{2.5}$-PEP Field Blanks: Trend in $PM_{2.5}$ Mass Over Time (2007-2016)

China Invites EPA to Provide Lectures on QA and Modeling

The China National Environmental Monitoring Center and the Hebei Provincial Environmental Monitoring Center jointly sponsored the Air Quality Assessment Divisions Mike Papp and the Dr. Richard Scheffe to provide lectures in the fields of data quality control and systematic quality management for the ambient air quality network and numerical modeling for air quality management respectively. These lectures also included an environmental monitoring exchange for the 2022 Winter Olympics in China.

The lecture series encompassed three QA Lectures in three different cities (Baidaihe, Shijiazhuang, and Xingcheng) and travel 8 out of the 13 days we were in China.

Our oddessy started with a 16 hour flight to Beijing were we were met by one of our interpreters and taken by taxi to the Beijing train station for a 2-hour high speed rail to Badaihe Training Center where we gave our first lectures the next morning. Right after the lecture we were whisked back to the train station for a 3-hour high speed rail to Shijiazhuang where we gave our lectures at the Hebei Provincial Environmental Monitoring Center the very next day. If you are familiar with the QA-101 training we provide at the National Conference, the QA lectures were similar but at “78” speed. They started with our EPA QA Policy and went right on through to data validation and certification. In order to ensure we did not provide information overload, the QA lectures focused on $PM_{2.5}$ and ozone and took about 3 hours with the use of an interpreter.

Our travel companions also included Mathieu Sagat, a water quality expert from Aquascope, France and his interpreter Le Bao from Biotope (Sino-French cooperation) and Zhi Chen, from Concordia University, Canada. Our visits not only included ambient air monitoring sites/ facilities but also reservoirs and streams where China demonstrated their water quality monitoring activities.

After our first two lectures our visit proceeded on to tour one of Hebei Province’s ambient air monitoring stations and a reservoir. The following day we flew to Zhangjiakou where some of the 2022 Olympics will be held. Our hotel was outside the Olympic Park where every morning various exercises were being performed such as running, biking, tai-chi, dancing, top spinning, basketball, kite flying and whip cracking ...yes, whip cracking! At night the park was very active with dancing and laser light displays. From Zhangjiakou we took a bus to Chongli where much of the Olympic skiing, ski jumping and bobsledding will take place. At the environmental monitoring offices in Chongli we were provided a presentation on the water quality and ambient air monitoring programs that were being developed for the Winter Olympics. Although we have not been provided with a English version of the presentation, the ambient air monitoring program appeared very thorough and is being developed with fixed monitoring stations as well as an extensive use of sensor technology.

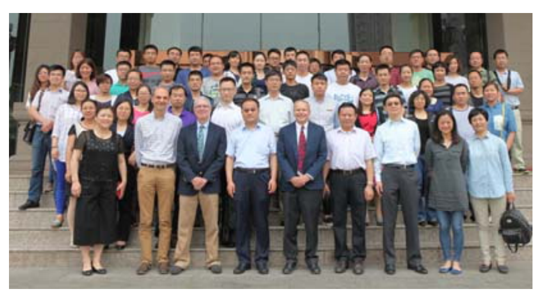
After visiting the Olympic ski sites we also taken to the top of the mountain where the Monitoring Center was planning on installing a monitoring site to measure background conditions and where they also had an extensive array of wind power electrical turbines.

At Chongli getting a description of the Olympic Venue

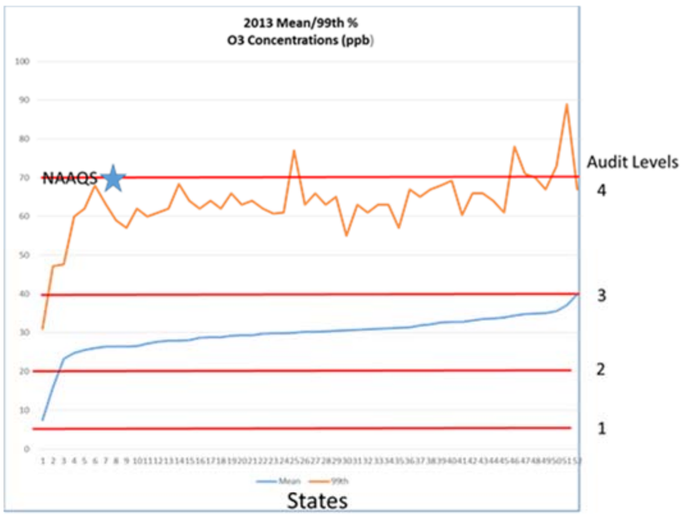
Once back in Shijiazhuang we visited the facilities of Sailhero which manufactures much of the ambient air monitoring equipment used in China as well as the sensors that will be deployed for monitoring during the Olympics. We had additional discussion on the proposed monitoring program as well as a tour of their facility. The sensors shown in the picture where being compared against data from a fixed monitoring station with FRM/FEM-like equipment.

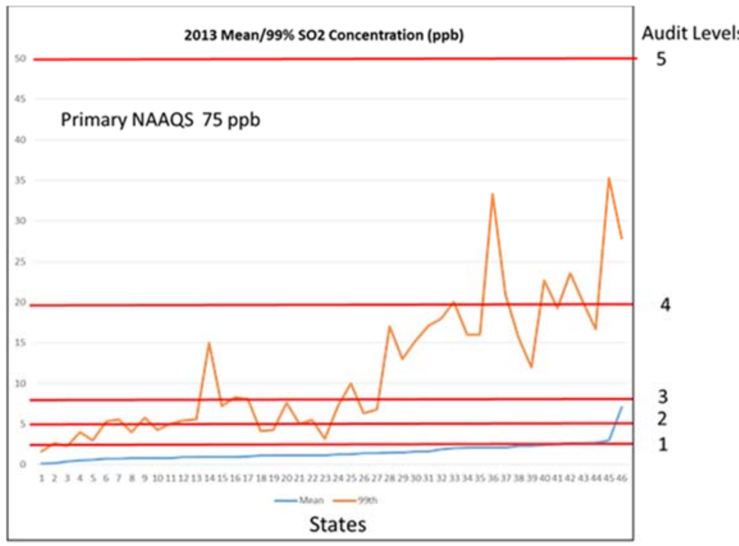
We then took a train back the Beijing for the weekend where we had a few days to take in the sites like the Great Wall and the Forbidden City. Our final destination was a three hour train ride to the Xingcheng Environmental Training Center were we gave our last lectures. Xingcheng was a beautiful training center in a quaint seaside resort town and it was a great way to finish up the lecture series.

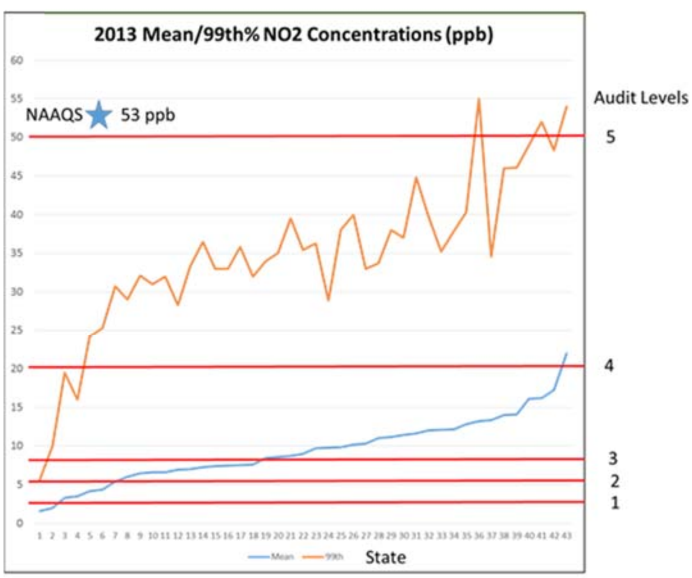
We had a wonderful experience and were totally blown away by the hospitality of our hosts. Meals where un unforgettable experience. Our lectures were primarily attended by a young audience, mostly in the early twenties to thirties and keenly interested to taking notes and capturing lectures on smart phones. Questions after the lectures however were very few. However, as a presumed follow-up, during my lectures I had mentioned our standard reference photometer (SRP) program that provides traceability of all our ozone monitors back to NIST. Scott Moore from EPA ORD is currently in the process of inviting four scientists from China to visit EPA RTP to understand our SRP verification process. International cooperation has been established!

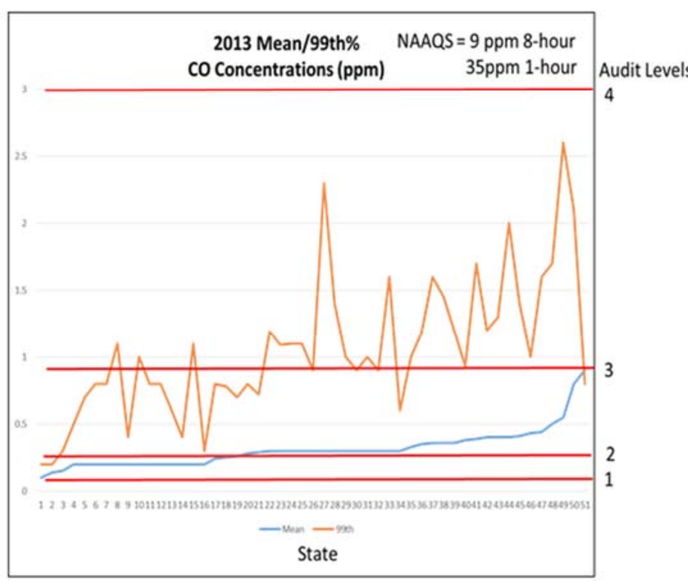


2013 Routine Gaseous Pollutant Data Mean an 99th percentile by State Including Annual PE Audit Levels for Illustration









EPA-OAQPS
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RTP, NC 27711

E-mail: papp.michael@epa.gov

The Office of Air Quality Planning and Standards is dedicated to developing a quality system to ensure that the Nation's ambient air data is of appropriate quality for informed decision making. We realize that it is only through the efforts of our EPA partners and the monitoring organizations that this data quality goal will be met. This newsletter is intended to provide up-to-date communications on changes or improvements to our quality system. Please pass a copy of this along to your peers and e–mail us with any issues you'd like discussed.

Mike Papp

Key People and Websites

Since 1998, the OAQPS QA Team has been working with the Office of Radiation and Indoor Air in Las Vegas, and ORD in Research Triangle Park in order to accomplish OAQPS's QA mission. The following personnel are listed by the major programs they implement. Since all are EPA employees, their e-mail address is: last name.first name@epa.gov.

The **EPA Regions** are the primary contacts for the monitoring organizations and should always be informed of QA issues.

Program	Person		Affiliation
CSN/IMPROVE Lab PE and $PM_{2.5}$ Round Robin	Jenia	McBrian Tufts	OAQPS
Tribal Air Monitoring	Emilio	Braganza	ORIA-LV
CSN/IMPROVE Network QA Lead	Jenia	McBrian Tufts	OAQPS
OAQPS QA Manager	Joe	Elkins	OAQPS
Standard Reference Photometer Lead	Scott	Moore	ORD-APPCD
National Air Toxics Trend Sites QA Lead	Greg	Noah	OAQPS
Criteria Pollutant QA Lead	Mike	Papp	OAQPS
NPAP Lead	Mark	Shanis	OAQPS
$PM_{2.5}$ PEP Lead	Dennis	Crumpler	OAQPS
Pb PEP Lead	Greg	Noah	OAQPS
Ambient Air Protocol Gas Verification Program	Solomon	Ricks	OAQPS

Websites

Website	URL	Description
EPA Quality Staff	EPA Quality System	Overall EPA QA policy and guidance
AMTIC	http://www3.epa.gov/ttn/amtic/	Ambient air monitoring and QA
AMTIC QA Page	http://www3.epa.gov/ttn/amtic/quality.html	Direct access to QA programs