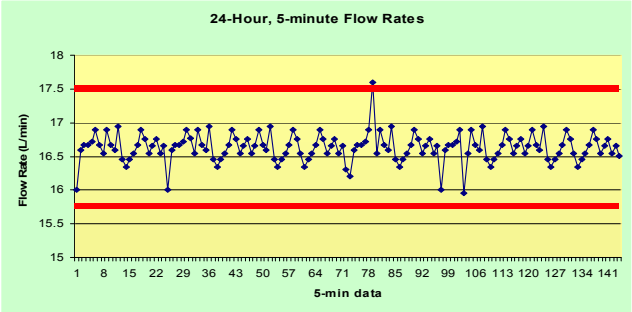
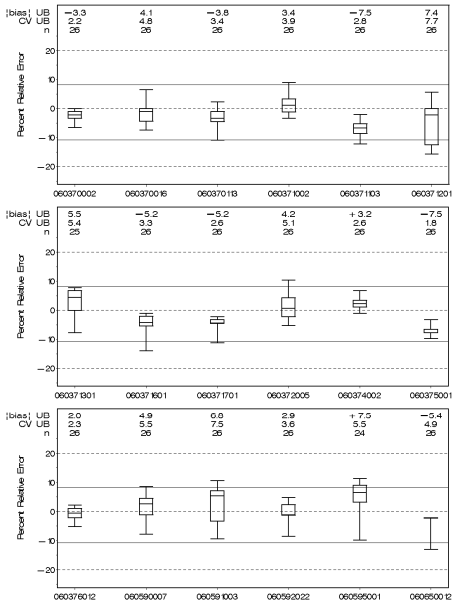


Appendix A in Half-A-Day

A walk through of 40 CFR Part 58 Appendix A



Our Trainers

Dennis Crumpler ***Mathew Plate***
Donovan Rafferty ***Mark Shanis***
Greg Noah ***Mike Papp***
Melinda Ronca-Battista

Training Goal

- Provide the big picture
  - From a requirements standpoint
- Don't expect too many details
  - We'll try to make it "Real World"
  - See Handbook guidance
  - Ask some questions… but!
- Provide feedback
  - In the context of a 1/2-day session
  - What worked, what did not, what would you skip, for what areas do you want/need more information?

Prelude for Newcomers

- The words we use……AAMG, APTI, ADQ, AMTIC, ANSI, AQAD, AQI, AQS, ARM, ASTM ASQ, AWMA, CAA, CFR, CL, CBSA, CMSA, CMZ, COC, CPU, CSA, CSN, CRM, CV, DAS, DASC, DQA, DOP, DQI, DQOs, EDO, EDERF, EPA, FEM, FR, FRM, GC/MS, GIS, GLP, GMIS, HAP, HC, HPLC, HVAC, ICP, IMPROVE, IT, LDL, LIMS, MDL, MFC, MPA, MQOs, MSA, NAAQS, NACAA, NATTS, NECTA, NEIC, NTAA, NTEC, NCore NERL, NIST, NPS, NPAP, NPEP, NTRM, OAQPS, OMB,ORD, ORIA, P&A, PAMS, PC, PE, PEP, PBMS, ppb, ppm, PSD, PQAO, PT, QA, QA/QC, QAARWP, QAD, QAM, QAO, QAPP, QMP, RPO, RSD, SD SIPS, SLAMS, SOP, SPMS, SRM, SRP, STN, TAD, TEOM, TIP, TSA, TSP, TTL, TTP,USB, USGS, UTM, USP, VAC, VOC …

Quality Assurance...What is it., and why do we need to do it?

WHAT?

E4- Part of quality management focused on providing confidence that quality requirements will be fulfilled.

Another Definition- A system developed to ensure the information derived from measurements are of a quality that the decision maker is willing to risk making a wrong decision.

Premise 1 - All estimates have error so all decisions made with estimates have risks.
Premise 2- We can't afford 100% certainty in our decisions

WHY?

Some decisions will be inappropriate (wrong) due to data uncertainty… (error)

…the difference between your measurement (estimate) and the "truth"

"(2) Establishment of a national network to monitor, collect, and compile data with quantification of uncertainty in the status and trends of air emissions, deposition, air quality, surface water quality, forest condition, and visibility impairment and to ensure the comparability of air quality data collected in different States and obtained from different nations."

How do we quantify uncertainty and ensure comparability?

Q:\COMP\ENVIR1\CLEANAIR.001

(c) AIR POLLUTANT MONITORING, ANALYSIS, MODELING, AND INVENTORY RESEARCH.—In carrying out subsection (a), the Administrator shall conduct a program of research, testing, and development of methods for sampling, measurement, monitoring, analysis, and modeling of air pollutants. Such program shall include the following elements:

(1) Consideration of individual, as well as complex mixtures of, air pollutants and their chemical transformations in the atmosphere.

(2) Establishment of a national network to monitor, collect, and compile data with quantification of certainty in the status and trends of air emissions, deposition, air quality, surface water quality, forest condition, and visibility impairment, and to ensure the comparability of air quality data collected in different States and obtained from different nations.

(3) Development of improved methods and technologies for sampling, measurement, monitoring, analysis, and modeling to increase understanding of the sources of ozone percursors, ozone formation, ozone transport, regional influences on urban ozone, regional ozone trends, and interactions of ozone with other pollutants. Emphasis shall be placed on those techniques which—

(A) improve the ability to inventory emissions of volatile organic compounds and nitrogen oxides that contribute to urban air pollution, including anthropogenic and natural sources;

(B) improve the understanding of the mechanism through which anthropogenic and biogenic volatile organic compounds react to form ozone and other oxidants; and

(C) improve the ability to identify and evaluate region-specific prevention and control options for ozone pollution.

(4) Submission of periodic reports to the Congress, not less than once every 5 years, which evaluate and assess the effectiveness of air pollution control regulations and programs using monitoring and modeling data obtained pursuant to this subsection.

(d) ENVIRONMENTAL HEALTH EFFECTS RESEARCH.—(1) The Administrator, in consultation with the Secretary of Health and Human Services, shall conduct a research program on the short-term and long-term effects of air pollutants, including wood smoke, on human health. In conducting such research program the Administrator—

(A) shall conduct studies, including epidemiological, clinical, and laboratory and field studies, as necessary to identify and evaluate exposure to and effects of air pollutants on human health;

(B) may utilize, on a reimbursable basis, the facilities of existing Federal scientific laboratories and research centers; and

(C) shall consult with other Federal agencies to ensure that similar research being conducted in other agencies is coordinated to avoid duplication.

(2) In conducting the research program under this subsection, the Administrator shall develop methods and techniques necessary

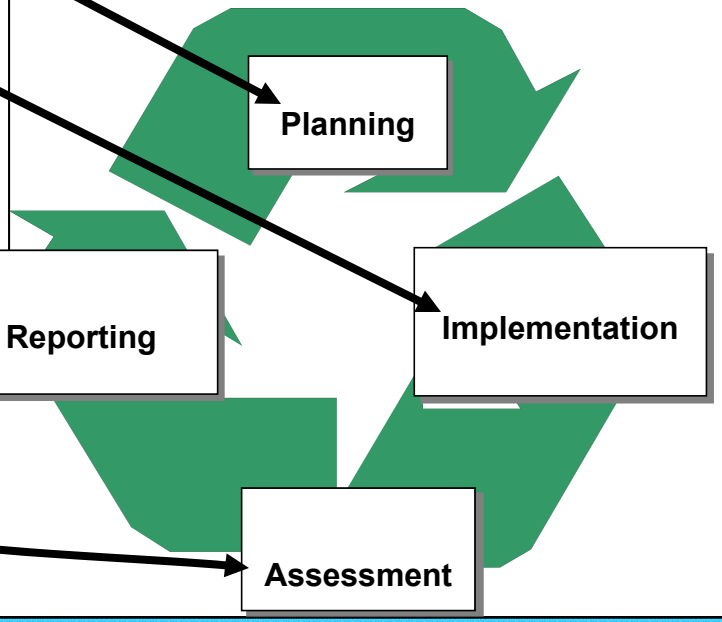
February 24, 2004

40 CFR Part 58 Appendix A

*Provides the minimum set of requirements to include in a **Quality System***

Sections

1. **General Information**
2. **Quality System Requirements**
3. **Measurement Quality Check Requirements**
4. **Calculations**
5. **Reporting**

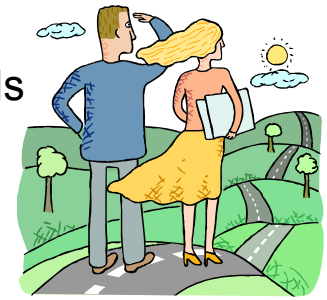


Major 40 CFR Pt. 58 App. A QA Requirements

* EPA QA Policy

- **Section 1**
  - General Info/Applicability
  - Differences SLAMs/PSD
  - Measurement uncertainty and checks
  - Assessment and Reports
- **Section 2**
  - QMPs/QAPPs*
  - Independent quality management function*
  - DQOs- (EPA)
    - $PM_{2.5}$, O_3, $PM_{10-2.5}$
  - National PE Programs
  - TSAs-(EPA Regions)
  - NIST Traceable Standards

There is so much more to QA beyond Appendix A



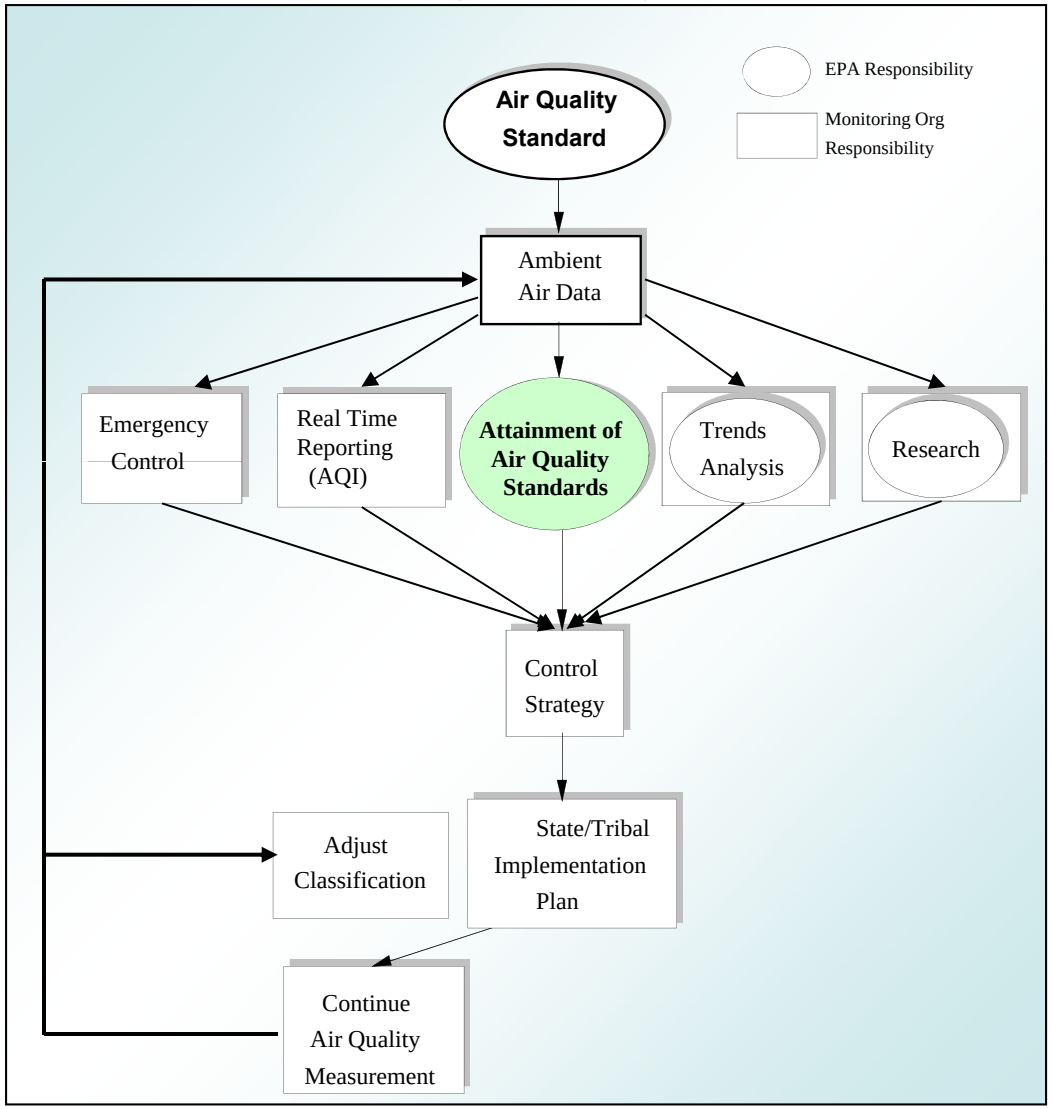
- **Section 3**
  - PQAO definition
  - Quality Control and Assessment
    - 1-point QC } Gaseous pollutants
    - Annual PE
    - Flow Rate Verification
    - Flow Rate Audit
    - Collocated Sampling } PM/Pb
    - Pb Analytical Audits
    - PEP
- **Section 4**
  - QA Stats
- **Section 5-**
  - Reporting Req.
    - List- Site ID/PQAO by pollutant
    - Quarterly submission of QA per 58.16 reporting requirements
    - Calculation of QA (EPA) once annual submission occurs

Section 1
General Information

Provides the setting / context of Appendix A

- Applicability
- Measurement Uncertainty
- Measurement Quality Checks
- Assessments and Reports

Monitoring Objectives



Section 1 –Applicability

Generally for comparison to NAAQS

- SLAMS (NCore a subset),
- Special Purpose Monitors (SPMs)
  Using FEM/FRM/ARM and meeting App E siting criteria
- Tribal Monitors
- PSD monitoring prior to construction to determine industry or municipal source impact on ambient concentrations
  Most requirements the same but there are differences. Differences spelled out in text and in Table A-1

"Non-regulatory" Monitor Type=

AQS Reporting Feature

- Monitors not using FRM/FEM/ARMs
- Not meeting Appendix E Siting Criteria
- Not meeting Appendix A QA criteria

•Not being used or required for regulatory purposes. Need to inform Regions

•Monitors can have multiple monitor types (e.g. Tribal, Non-regulatory)

- SLAMS monitors cannot use the non-regulatory monitor type

•Non-regulatory monitors can't be switched on and off for convenience.

Section 1 –Applicability - Pollutants

O_3, SO_2, $NO_{2,x,y}$, CO,

PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$, Lead (Pb)

What Other Networks have QA Programs?

CSN

Toxics

What Other QA Programs are Likely to Evolve?

PAMS

Section 1.2 - Measurement Uncertainty

Understanding and Controlling Uncertainty in Order to Minimize Decision Errors

Uncertainty = Natural (Population) Variability + Measurement Uncertainty

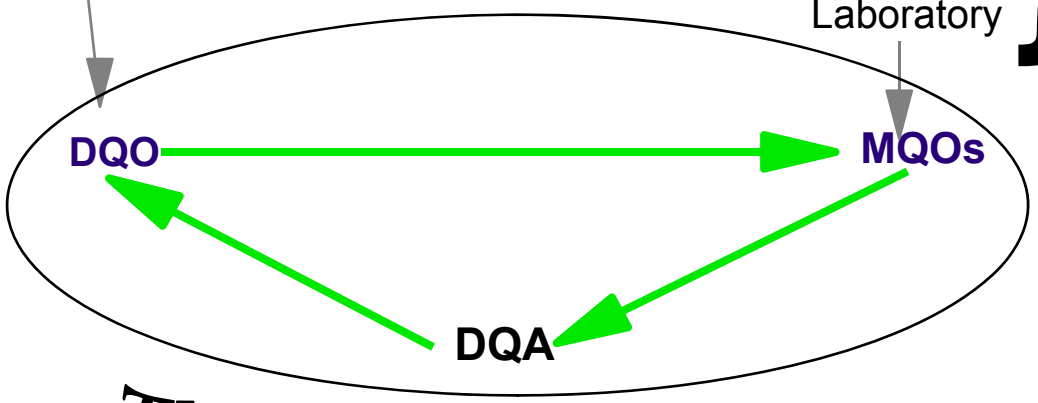
Spatial/Temporal

1. Representativeness

Preparation
Field
Laboratory

Data Quality Indicators

2.Precision*
3.Bias*
4. Completeness*
5. Comparability
6. Detectability*

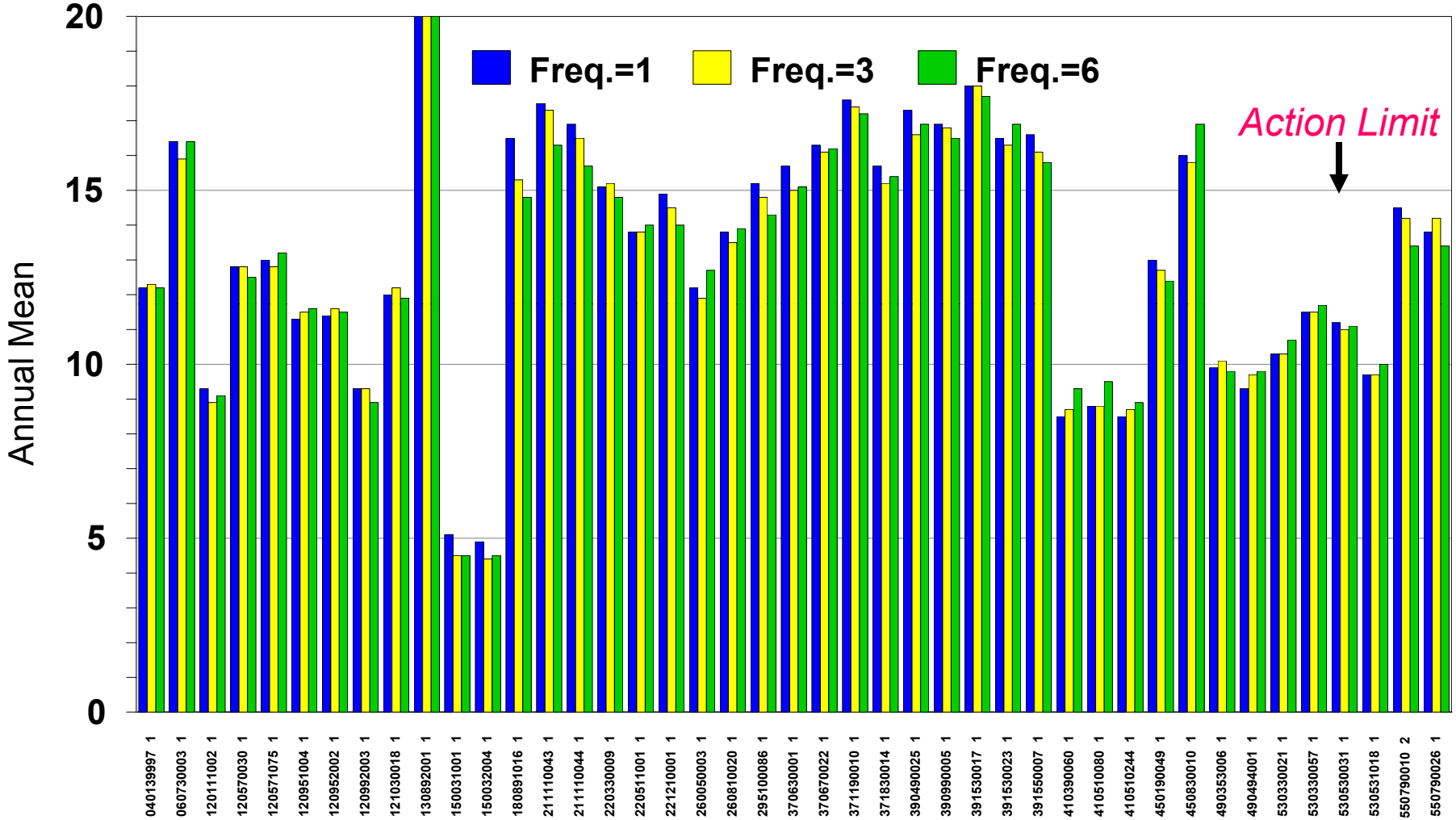


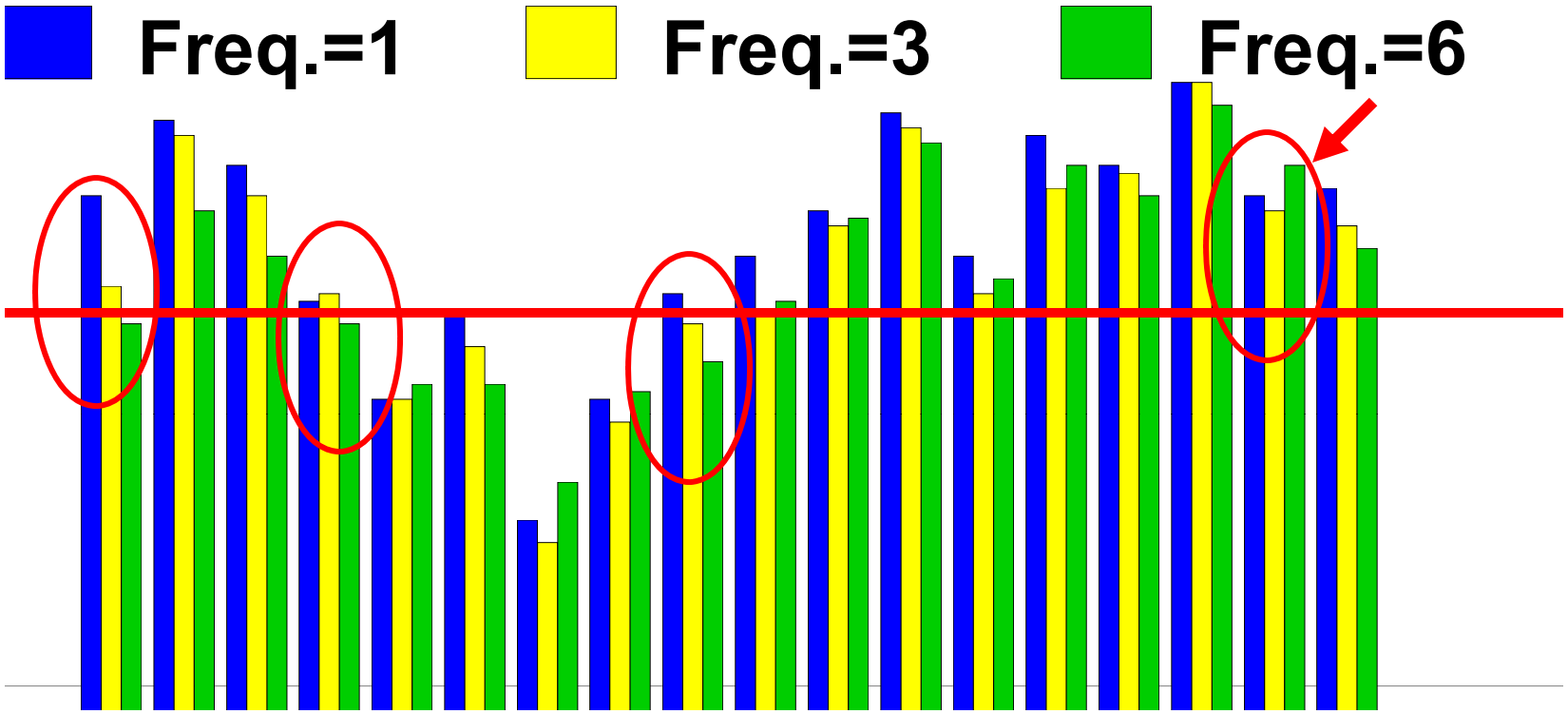
** Defined in App A*

The Quality System → *Documented in the QAPP*

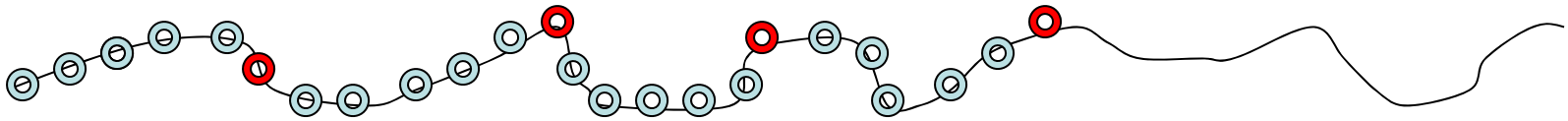
Temporal Representativeness of PM2.5 Sampling

Comparing Annual Means from Every Day sampling to those calculated from 1-in-3 and 1-in-6 frequencies. Only complete sites included.





Every day sampling does not always provide the highest mean conc., but does provide the user with more confidence in the annual estimate.



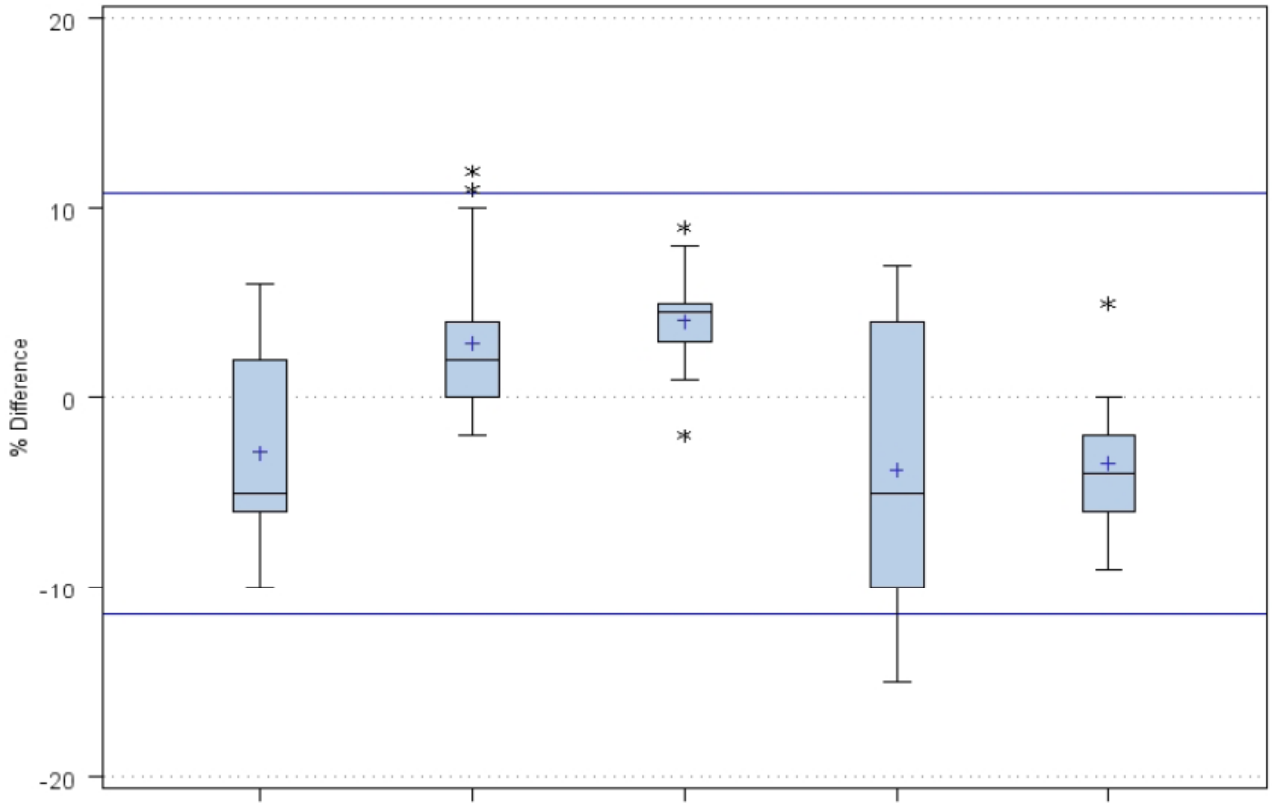
Section 1.2 -Measurement Uncertainty

- Deviations from the “true” concentration
- Defined in terms of data quality indicators:
  - Bias
  - Precision
  - Completeness
  - Detectability
  - Comparability

Other data quality indicators like comparability and representativeness are important but since they relate to sources of spatial/temporal variability outside the control of a monitoring organization such as meteorology, they are not included in Appendix A discussions.

Relationship Between Bias and Imprecision on Data Quality

AQS ID	720330008-1	720330009-1	720590017-1	720590018-1	721230003-1
CV	5.75	4.70	2.95	8.17	4.44
Bias	5.72	+4.42	+4.92	7.90	-5.20
# Obs	28	28	30	30	15



Section 1.2 -Measurement Uncertainty

Deviations from the "true" concentration

Data Quality Indicators

- Precision
- Bias
- Completeness
- Detectability
- Comparability

App A Types

- Collocation,1-point QC
- 1-point QC, PEP, NPAP, Flow
- Routine Data, QA Data
- LDL, MDL
- PEP, NPAP

Section 1.3 - Measurement Quality Checks

The quality control checks in Section 3 are required to be reported to AQS.

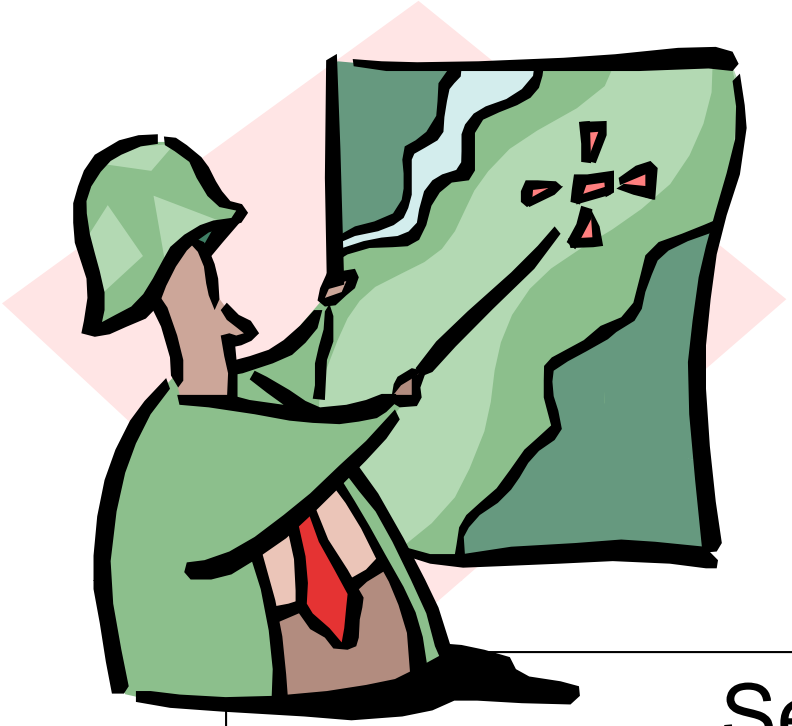
One exception- flow rate verifications are not required to be reported to AQS. However, they can be reported if desired.

One exception to the exception-Continuous PM10

Section 1.4 –Assessments and Reports

Key feature in the quality system

- Necessary to document data quality
  - Sections (3,4,and 5) describe the required assessments
- Monitoring organization QAPPs and QMPs should describe assessments performed at local levels.



40 CFR Part 58 Appendix A

Section 2
Quality System Requirements

Quality System- The game plan for an organization to collect quality data to make the right decision

Sec 2 Major Elements

- QAPP and QMPs
- Independence of QA
- Data Quality Requirements/DQOs/Meas. Uncertainty
- National Performance Evaluation Program (NPEP)
- Technical Systems Audits
- Gaseous and Flow Rate Audit Standards
- Primary Requirements and Guidance

2.1 QMPs, QAPPS and SOPs

QMP - Organization Specific
- Describes organizations quality system
- Establishes capability
- Written by management
- Approved by EPA

QAPP - Project Specific
- Identifies the reasons for collecting data, how the data are collected and how quality is maintained
- Written by QA team and technical staff
- Approved by EPA and/or Monitoring Org depending on QMP and QA structure

SOP - Instrument/Method Specific
- Ensures consistency from day to day and from one person to the next
- Included in QAPP or by reference
- Written by technical staff
- Approved through QAPP approval process

About

TURBO-QAPP QAPP View

Quality Assurance Project Plan

Version 1.3.6

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Lakes Environmental

About | Team | Technical Support | Web

OK

PROJECT POLLUTANTS

Ozone (O3)

- I. INTRODUCTION
- II. CATEGORY
- Element 6a (A6-1). POLLUTANT
- Element 5 (A5). BACKGROUND
  - Problem Definition
  - Problem Background
- Element 6b (A6-2). METHOD
- Element 6c (A6-3). DESCRIPTION
  - Summary
  - Project Information
  - Project Schedule
- Element 6f (A6-6). PROJECT LOCATION
- Element 4 (A4). ORGANIZATION
- Element 4b (A4-2). PROJECT ORGANIZATION
- Element 7a (A7-1). DATA QUALITY OBJECTIVES
  - Stating the problem
  - Identifying the decision
  - Identify the inputs to the decision
  - Define the boundaries of your project
  - Deciding on a decision rule
  - Specifying tolerable limits on decision errors
  - Optimize the design

Project Progress 14.2%

Introduction to the QAPP

An EPA approved Quality Assurance Project Plan is required to implement any work funded by the EPA that involve acquisition of environmental data generated from direct measurement activities, collected from other sources, or co from computarized databases and information systems.

This software will guide you through the creation of a Quality Assurance Project Plan (QAPP). A good QAPP is use cummunicate the specifications for implementation of the project design and to ensure that the project's quality obje achieved.

Before you begin to create your QAPP you will need to select which kind of QAPP you will be writting. Select from or Other in the pick list below.

Creating a QAPP for ...	Ambient Air
Enter Name of the Tribe	MELINDA'S TRIBE
Enter the name of your Tribal Office	MELINDA'S ENVIRONMENTAL OFFICE
Enter the name of tribal department	MELINDA'S AIR OFFICE

Institute for Tribal

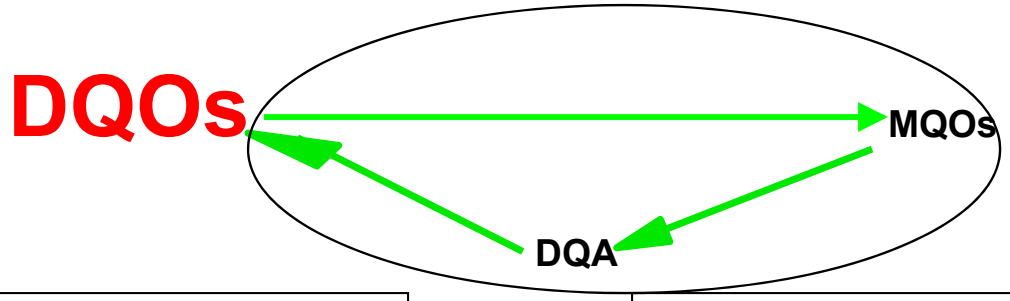
Northern Arizona University

QAPP Vi

2.2 Independence of QA

- Monitoring orgs. Must provide for a QA management function that has:
  - Sufficient technical and management authority to conduct independent oversight,
  - some organizational independence of environmental data generation activities
  - adequate resources both in personnel and funding to run the quality system

2.3 Data Quality Performance Requirements-DQOs



Designed to answer:

- What do you need?
- Why do you need it?
- How will you use it?
- What is your tolerance for errors?

DQO Process:

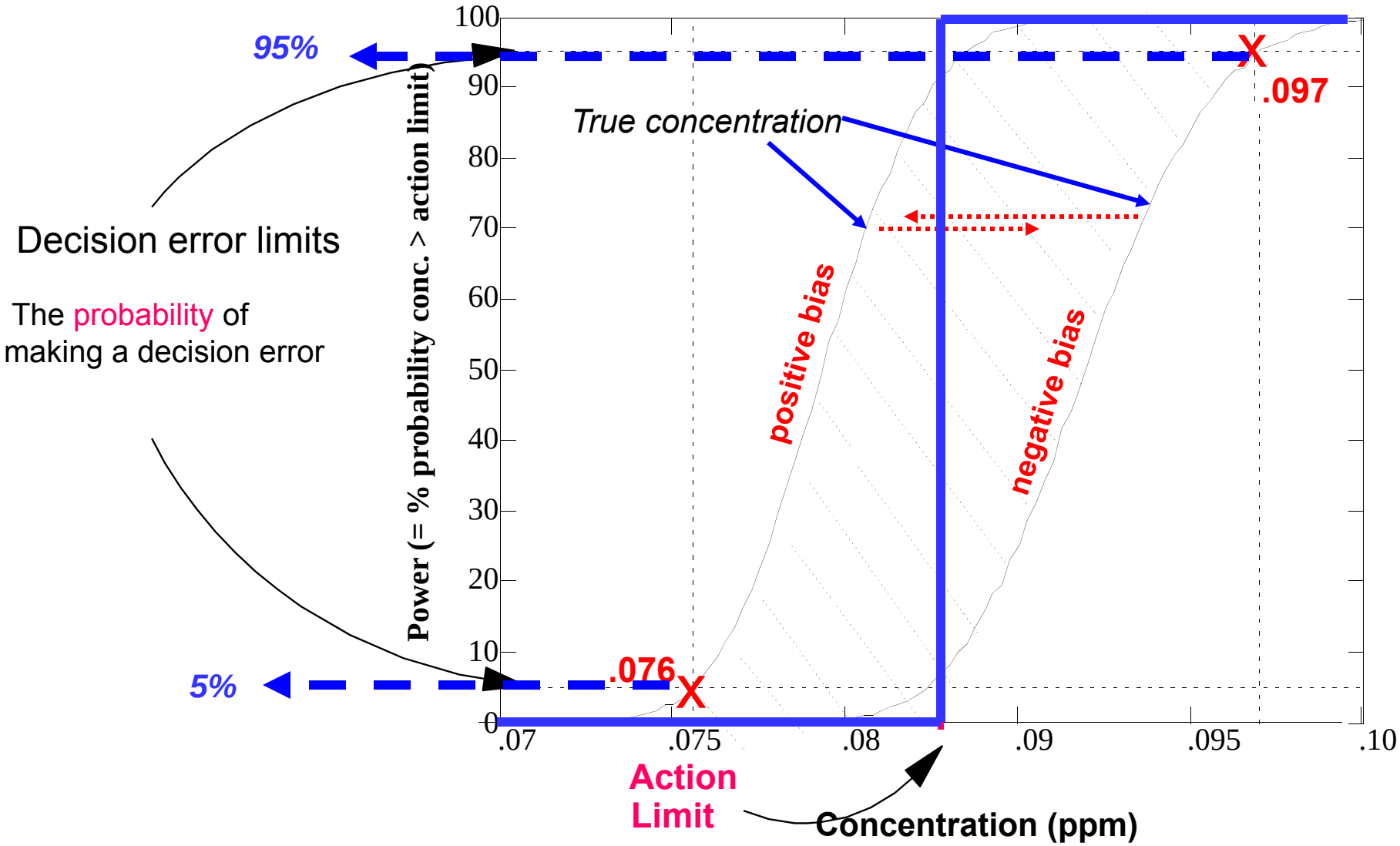
1. **State the problem to be resolved.**
2. **Identify the decision to be made.**
3. **Identify the inputs to the decision.**
4. **Define the boundaries of the study.**
5. **Develop a decision rule.**
6. **Specify the tolerable limits on decision errors.**
7. **Optimize the design for obtaining the data**

The DQOs in CFR are **goals.**

If the goals are not achieved decisions are made with less certainty

Ozone Performance Curve

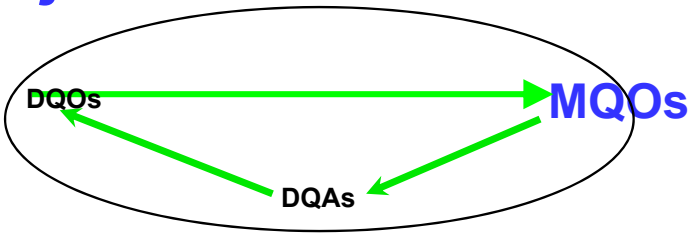
Probability that 3-year 4th highest max mean conc. > action limit



DQOS

- Based on precision and bias (P&B) data collected for a NAAQS attainment period
- Gaseous
  - P&B using the one-point bi-weekly precision checks.
- Particulate (PM and Pb)
  - Precision- Collocated sampling
  - Bias- Performance Evaluation Programs (PEP)
- DQO Reports posted on AMTIC (soon)
- Assessment statistics discussed in Section 4 of Appendix A

Measurement Quality Objectives and Data Validation Templates



- **MQOs are criteria that are used to evaluate the acceptability of QA/QC data**
- **Three subsets of MQOs were created by national QA workgroup to provide guidance to agencies for prioritizing data invalidation**
  - **Critical Criteria Table:**
    - These criteria *must* be met to ensure the quality of the data.
  - **Operational Evaluations Table**:
    - Data that do not meet these criteria indicate that there might be a problem and further investigation is warranted before making a determination about their validity.
  - **Systematic Issues Table:**
    - Criteria which are important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples.

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 7.1 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 7.1.2
Shelter Temperature Device Check	1/6 mo	± 2° C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.1.2
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	Percent difference ± 10%	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP Section ??
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 scale 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	1/year	single point difference ≤ ± 3%	1) 40 CFR Part 50 App D Section 5.4 2 and 3) Transfer Standard Guidance EPA-545/B-

Ozone Validation Template

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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	1/year	single point difference ≤ ± 3%	1) 40 CFR Part 50 App D Section 5.4 2 and 3) Transfer Standard Guidance EPA-545/B-

2.4 National Performance Evaluation Programs

- "Independent and adequate audits of all monitors providing data for SLAMS and PSD"
  - SLAMS - "air quality monitoring sites primarily needed for NAAQS comparisons . . . include NCore and PAMS."

NPEP SLAMS Programs

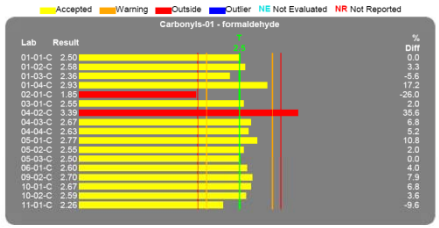
- Through-the-Probe (TTP) audit program
  - O_3, SO_2, CO, and NO_2
- NCore Trace TTP audit program
  - SO_2, CO, and NO_y
- $PM_{2.5}$ and $PM_{10-2.5}$ Performance Evaluation Program
- Pb Performance Evaluation Program
- Pb Audit Strip Program
- Protocol Gas Verification Program

NPAP-TTP

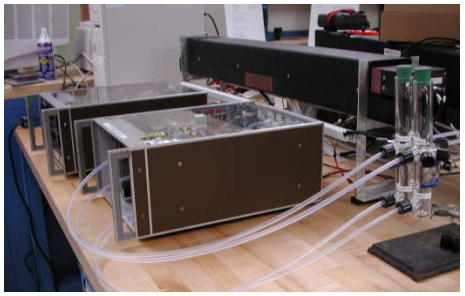
PEP

Related Audit Programs

- National Speciation Trends Network
- National Air Toxics Trends Network
- Ozone SRP
- EPA Regional Performance Audit Programs



NATTS PT &
ORIA Round Robins



SRP

Other SLAMS Programs

- PM_{10}
  - Previously under mail out system
- NCore / PAMS Meteorology
  - Under development
- PAMS precursors
  - Some Regional Programs / Under development

PM10 Audit

Collocated Met Audit

PAMS Cylinders

PE's Can

- Determine data comparability and usability across sites, monitoring networks, instruments and laboratories.
- Ensure monitoring systems are operating within an acceptable level of data quality.
- Verify the precision and bias estimates performed by monitoring organizations.
- Identify where improvements (technology/training) are needed.
- Assure the public of non-biased assessments of data quality.
- Provide a quantitative mechanism to defend the quality of data.

CFR Language on PEP/NPAP Responsibilities

- Part of 40 CFR Part 58 Appendix A QA Requirements
  - Any data used for comparison to the NAAQS must meet these regs.
- PEP and NPAP are SLT Responsibility
- Audits must be adequate & independent
  - Some of this defined in guidance, some in the regulation

PEP/NPAP Implementation Decisions

- Flexible implementation
  - SLT
  - Federal - with STAG funds
    - Decision made by Primary Quality Assurance Organization every year (June- July Timeframe)
    - Watch for Memo

Adequate NPAP/PEP (abridged version)

Gaseous NPAP

- Performing audits at a risk-targeted 20% of monitoring sites/instruments
- Data submission to AQS
- TTP delivery system
- Follow NPAP field/lab SOP critical performance criteria
- Use of audit gasses that are NIST certified and validated at least once a year
- Validation/certification with the EPA NPAP program
- Incorporated in QAPP

PEP

- Valid audits of 5 or 8 per PQAO per year
- Data submission to AQS
- Use of independent personnel, sampling devices (FRMs) weighing laboratory and standards
- Follow PEP field/lab SOPs critical performance criteria
- Follow PEP validation criteria
- Validation/certification with the EPA PEP program
- Incorporated into QAPP

Other NPAP TTP Features

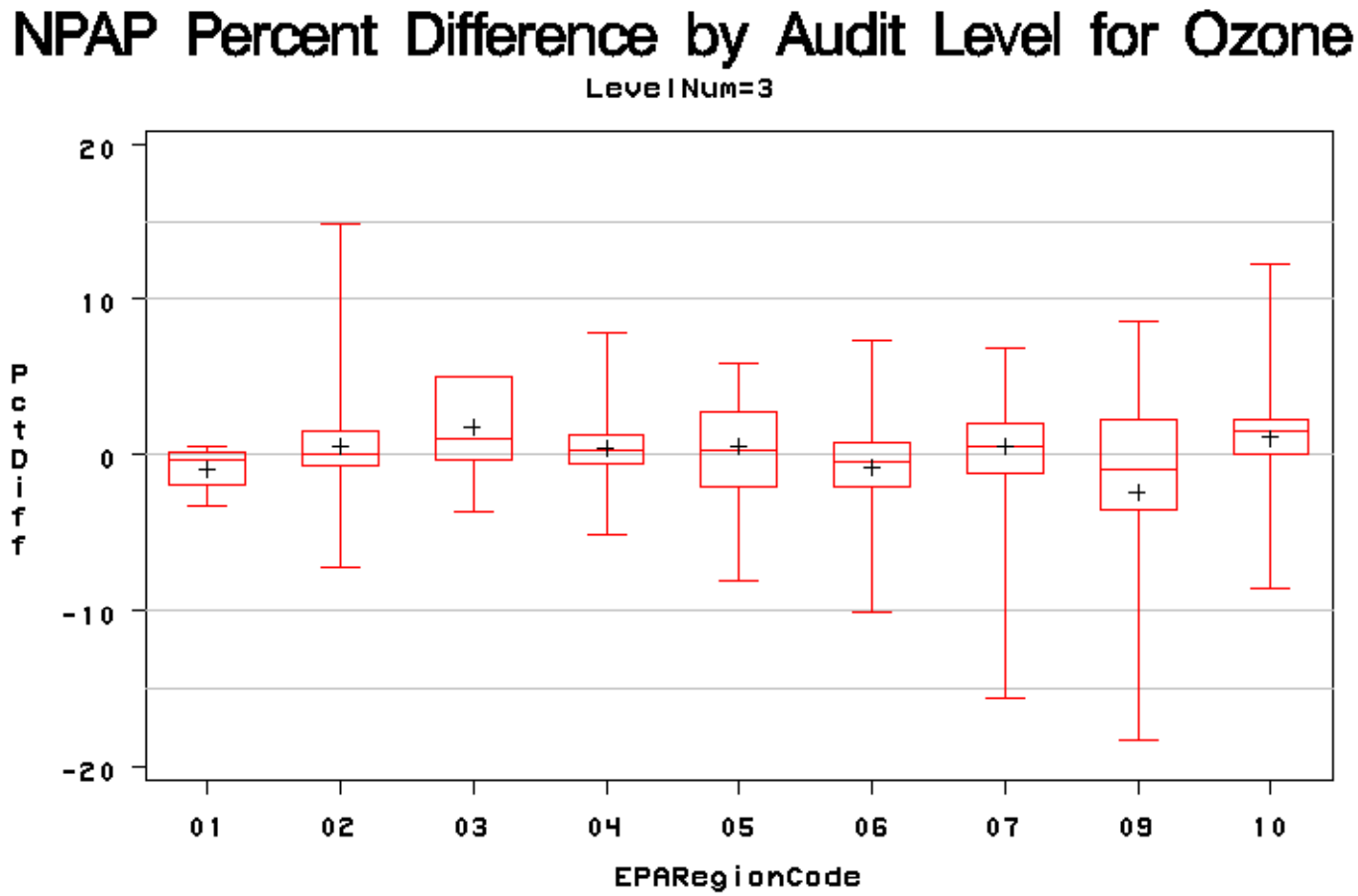
- Test gas generation and direct ozone and CO analyzer calibration on site, just prior to audit; SO2 & NO2 by CO
- Preliminary results to agency operator ON SITE
- Inter-Regional Sharing, a little state implementation
- Data Reported to AQS

Why 2.4, Not Just 3.2.2

- Independent Checking of the Checkers
- Independently quantifying the adequacy of each agency's audits (how well are they doing the audits)
- Purpose of audit and audit result acceptance criteria is to help agencies identify possible system problems to find, if real, and correct, NOT to invalidate data
- Quantification of data comparability at a national level
- If not EPA, then who?

After the Audit-What Happens If Is an Excedance

- If 1 or More Points Exceeding %D Limit
- Agency follow-up/troubleshooting
- If the auditor is EPA (Reg.1,2 and part of Reg. 7) EPA can re-audit before leaving (possibly)
- If the auditor is a contractor, then the re-audit may/probably will have to be scheduled at a later time.
- If problem exists and re-audit cannot occur that day, report follow up to Region
- Depending, Region may schedule a re-audit


NPAP Percent Difference by Audit Level for Ozone
LevelNum=3
20
10
0
-10
-20
PctDiff
01
02
03
04
05
06
07
09
10
EPARegionCode

Site %Diff Excedances, by Region, in 2004-2011(*Reg.1TTP start in ’08)

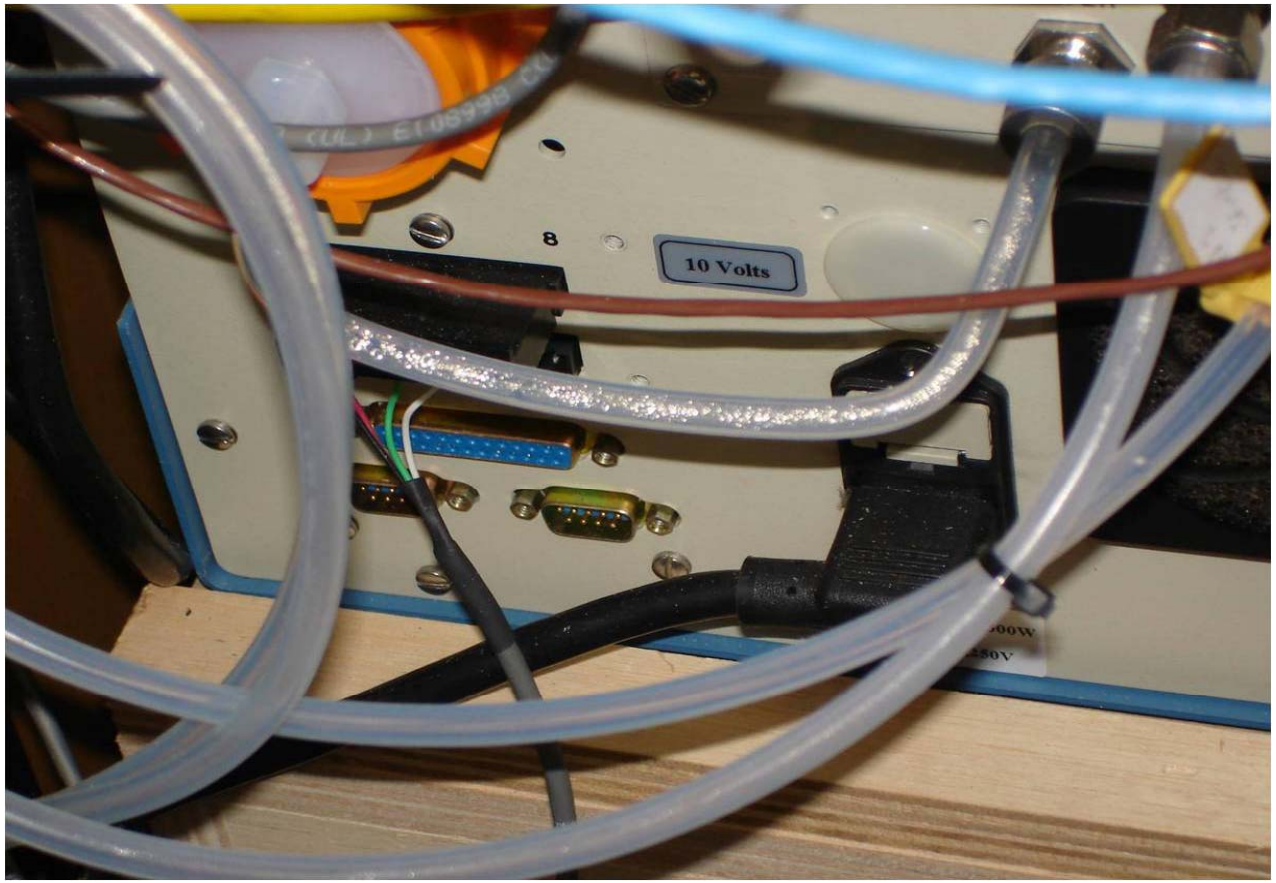
Region	1	2	3	4	5	6	7	8	9	10
2011	?	1	3	3	6	1	1	0	2	1
2010	0	7	7	1	7	1	1	0	1	2
2009	3	3	1	6	3	0	0	0	6	0
2008	1	1	5	6	2	0	1	0	4	0
2007	*	5	5	0	1	10	1	2	1	0
2006	2					3				
2005	*	4	2	3	1	10	2	0	2	1
2004	*			1		2			8	

PROBLEMS NOTED AT SITES; or, WHY DO TTP?

There have been findings that could lead to the reduction in significant problems during future audits.

- dirty manifold
- dirty connectors
- leaky joints
- difficult access
- dirty sample lines
- dirty particulate filter holders
-water in line

Water in Line

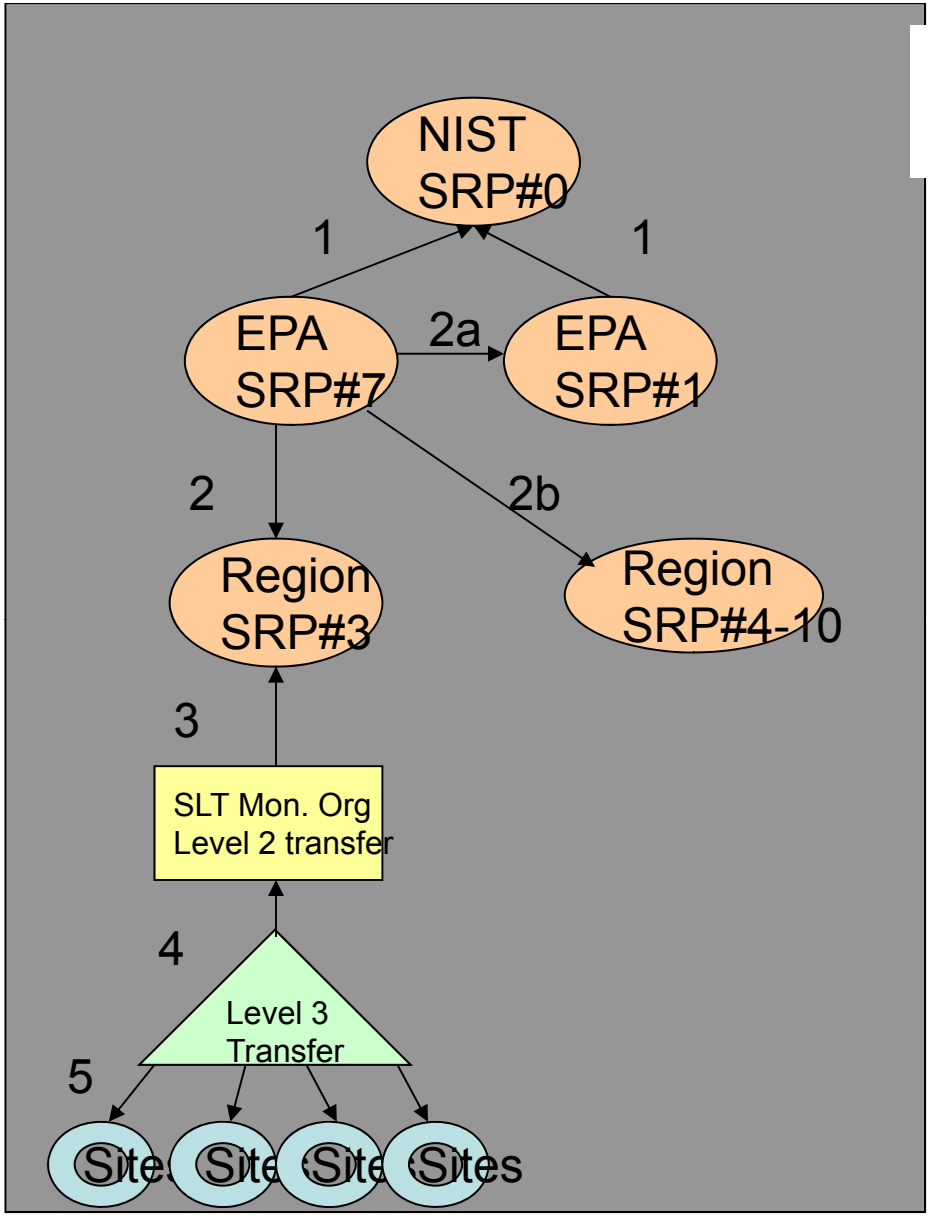


Standard Reference Photometer (SRP)-Certification Program

- We can't keep ozone in a container, so…
- NIST has made ozone SRPs for the world
- EPA has a US network of 2 in RTP& 9 in the Regions;1EPA RTP SRP is used to link the Regions to the NIST SRPs
- 1of the 2 NIST SRPS links US to the world
- Addressed in1st Ozone Guidance Revision since1979-see AMTIC, May,2009

Schedule for SRP Verifications and Upgrades-Who,What,Where,When

Standard Reference Photometer Schedule For Verification and Bias Upgrades						
PRIORITY	DUE DATE	SRP	Region	Location	Name	Bias Upgrade
1	05/03/12	5	6	Houston, TX	John Lay	NEXT
2	07/03/12	8	8	Golden, CO	Joshua Rickard	Finished
3	08/05/12	36	9	Richmond, CA	Barbara Bates	Finished
4	09/22/12	4	10	Sacromento, CA	Jerry Freeman	Finished
5	10/23/12	13	7	Kansas City, KS	James Regehr	Finished
6	10/26/12	10	4	Athens, GA	Mike Crowe	Finished
7	11/15/12	1	RTP	RTP, NC	Scott Moore	Finished
8	11/15/12	7	RTP	SRP7 to NIST	Scott Moore	Finished
9	02/08/13	9	1	N. Chelmsfield, MA	Chris St. Germain	Finished
10	02/27/13	3	2	Edison, NJ	Avraham Teitz	Finished
11	03/16/13	6	5	Chicago, IL	Scott Hamilton	Finished

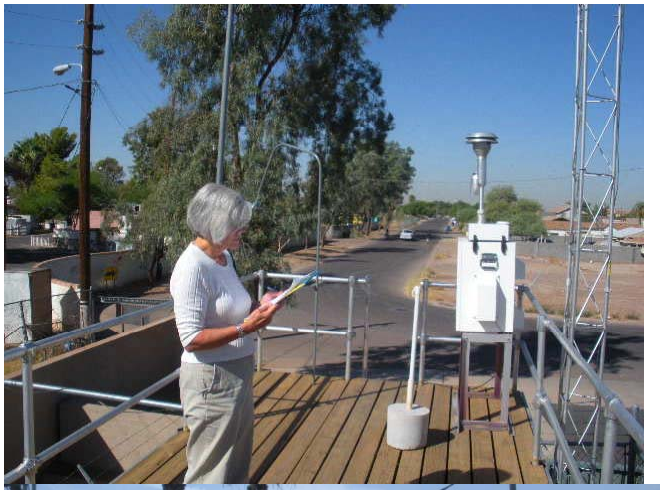


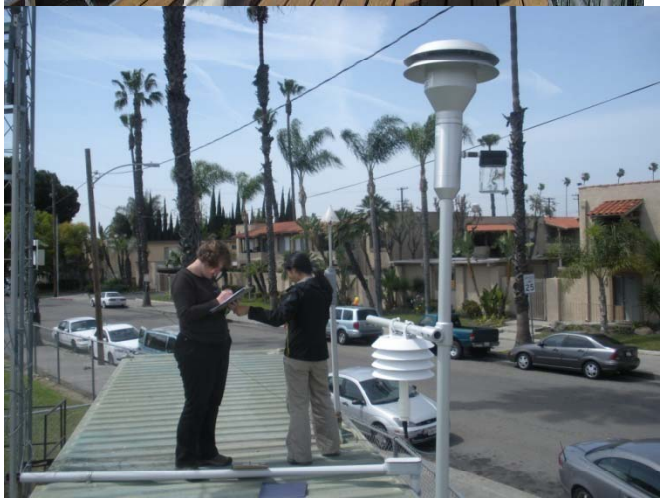
O3 Traceability ScenarioTerms

1. EPA SRP 1 & 7 certified at NIST each year
   - SRP #7 travels to Regions
   - SRP # 1 stays home
2. SRP # 7 certifies Regional SRPs
   - a- Upon completion of one audit SRP #7 gets verified by SRP #1
   - B- before going to next Region
3. SLT Mon. Org.(PQAO) brings it's level 2 transfer standard to Region SRP
   - Level 2 stays at lab
4. SLT Mon. Org. (PQAO) brings levels 3 and 4 transfer standard in to certify against Level 2 and then takes level 3 to site; some also bring TS to Regional SRP
5. TS certifies site's **working standard**

2.5 Technical Systems Audits

- Systematic evaluation of Quality Management, Technical Procedures, and Information Management to independently verify the quality and integrity of ambient air monitoring data
- Required to be conducted by EPA Regional Offices at least every three years for each “ambient air monitoring organization



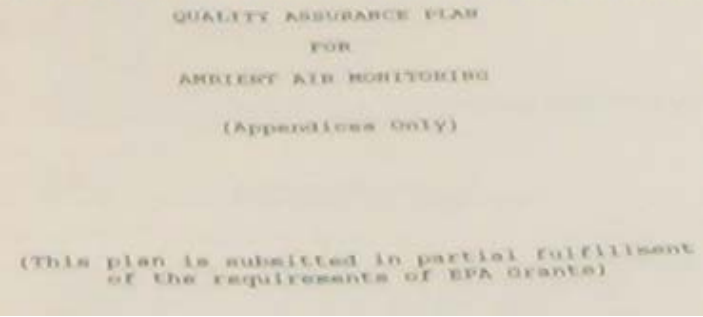


Types of TSAs

- Organizational TSA:
  - Comprehensive evaluation of all ambient air monitoring programs that report data funded by EPA or used to support EPA decisions.
  - Focus on ambient air data used to support NAAQS decisions
- Program Specific TSA:
  - Focus on a single environmental program at a single organization
  - Conducted on non-NAAQS monitoring programs (Toxics/PAMS/PM Speciation)

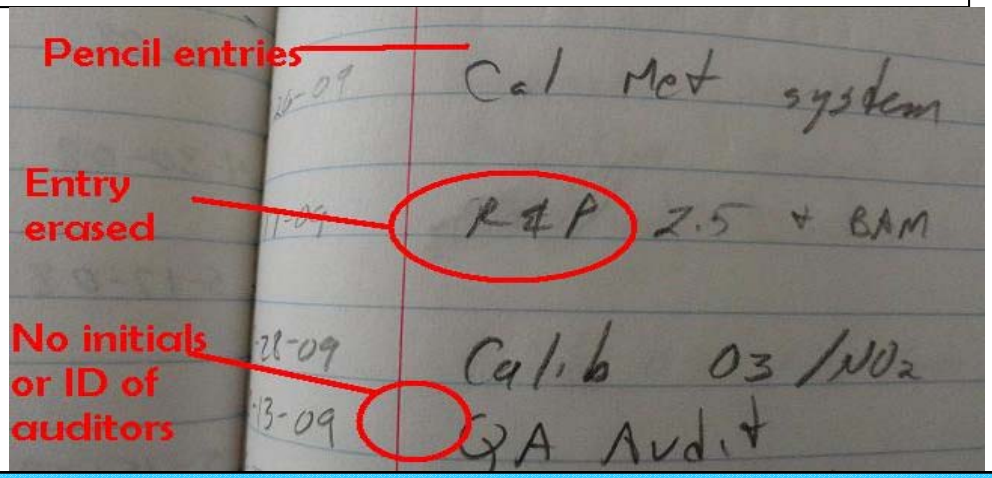
Main Objectives of TSAs

- **<u>Ensure adherence to Regulatory Requirements</u>**
- Evaluate technical procedures for effectiveness, adherence to QA plans and SOPs, and efficiency
- Ensure that Documentation is present and defensible to support all activities
- Ensure that data reported to AQS is accurate


QUALITY ASSURANCE PLAN
FOR
AMBIENT AIR MONITORING
(Appendices Only)

(This plan is submitted in partial fulfillment of the requirements of EPA Grants)

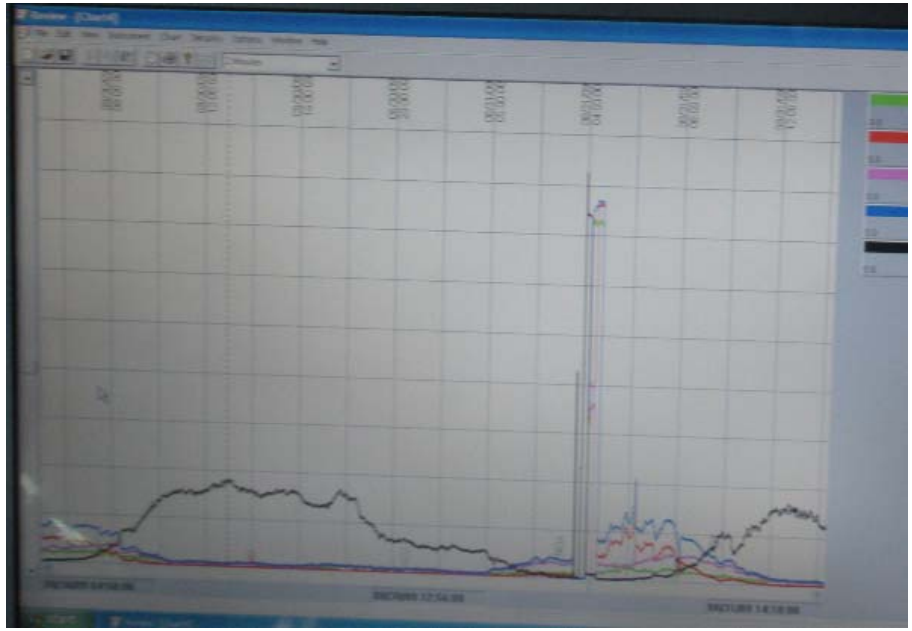
June 1987



Secondary Objectives of TSAs

- Promote consistency and best practices
- Obtain on-site knowledge of each organizations' operations and field sites

- Gather feedback from organizations on EPA required monitoring systems
- Learn new and better ways of monitoring



Guidelines for TSAs

- Quality Assurance *Handbook for Air Pollution Measurement Systems Volume II* (Redbook)
- EPA QA/G-7 Guidance for Technical Audits
- Air Monitoring Audit Checklists and guidelines developed by Air QA Workgroup and OAQPS

Contractors and Suppliers

Questions	Yes	No	Comments
Does your agency utilize any contractors in your air monitoring program? If no, skip to the next table. General process through procurement for State contract None of these went through panel process. For Pima lab services have lincenced lab.	X		Air Resource Specialist, Inc. in Fort Collins, CO provides support services for the Nephelometers/Visibility Network. ARS also provides support for our Data Collection System (DCS) Eastern Research Group, Inc. in Morrisville, NC provides laboratory analyses for air toxics samples. RTI International in Research Triangle Park, NC provides laboratory analyses for PM2.5 speciation samples. Pima County Wastewater Reclamation Lab (PCWRL) in Tucson, AZ provides analysis of Pb filters. Independent Contractors – are hired by ADEQ to perform filter changes for particulate matter samplers operated at certain sites outside of the Phoenix metropolitan area.
Who is responsible for oversight of contract personnel?	Bernard Lum for Independent Contractors Mark Carrel, Bryan Paris, & Bernard Lum for ARS Bryan Paris for PCWRL EPA Headquarters for establishing national contracts with ERG and RTI		

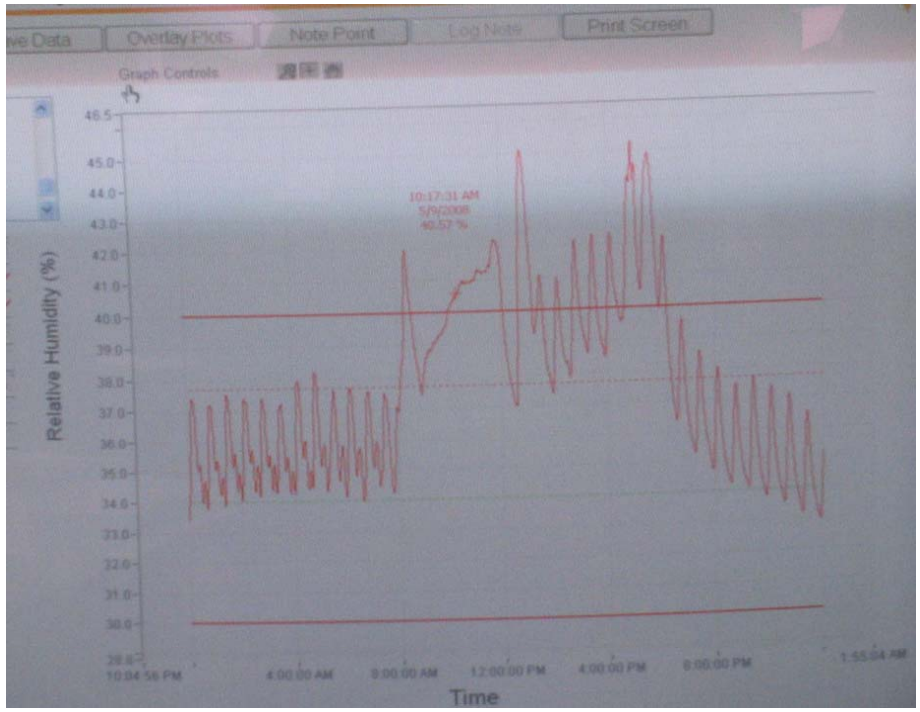
Ceresa has made site visit. Doc on how to handle filters.

Have not audited since last tsa

Checklists can be filled out by the organization prior to audits and can be used by the auditors to guide the TSA.

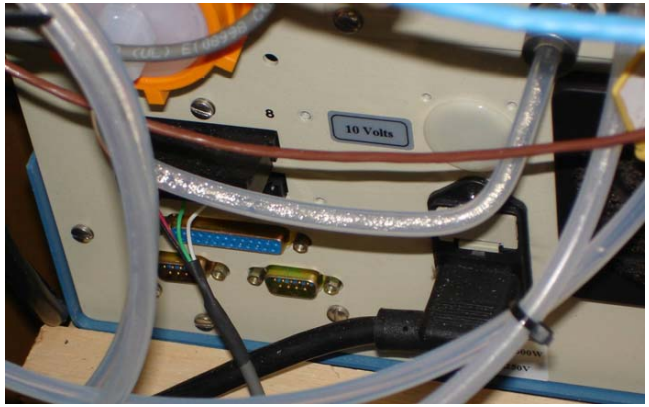
TSA Components

- Review of
  - Quality Management Program
  - Network Design and Field Sites
  - Field Operations
  - Laboratory Operations
  - Data Management



Top TSA Findings

1. QAPP/SOPs - not present/current
2. Documentation
3. QC - not done/documented
4. Calibrations
5. AQS - data improperly coded
6. Field Stations - not maintained
7. Siting
8. Residence Time
9. Expired Standards
10. Corrective Actions - incomplete



Formal Corrective Action

- Used to resolve significant issues identified during TSAs, Performance Audits, and routine operations.
  - Problem is resolved openly and formally
  - Correct immediate problem
  - Identify and correct impacted data (if any)
  - Identify and correct root-causes of the problem
  - Independent review and approval of resolution

2.6 Gaseous and Flow Rate Audit Standards

- Defines standard requirements for:
  - Carbon Monoxide
  - Sulfur Dioxide
  - Nitrogen Oxide and Nitrogen Dioxide
  - Ozone
  - Flow
- Other Standards not Specified
  - Particulate
  - Lead
  - Zero Air
  - Toxics
  - Ozone Precursors

Calibration Gas Standard Certification Programs

Programs for periodically comparing gas calibration standards to NIST – SRP,PGVP-And the Secret Word for today is **”TRACEABILITY”**

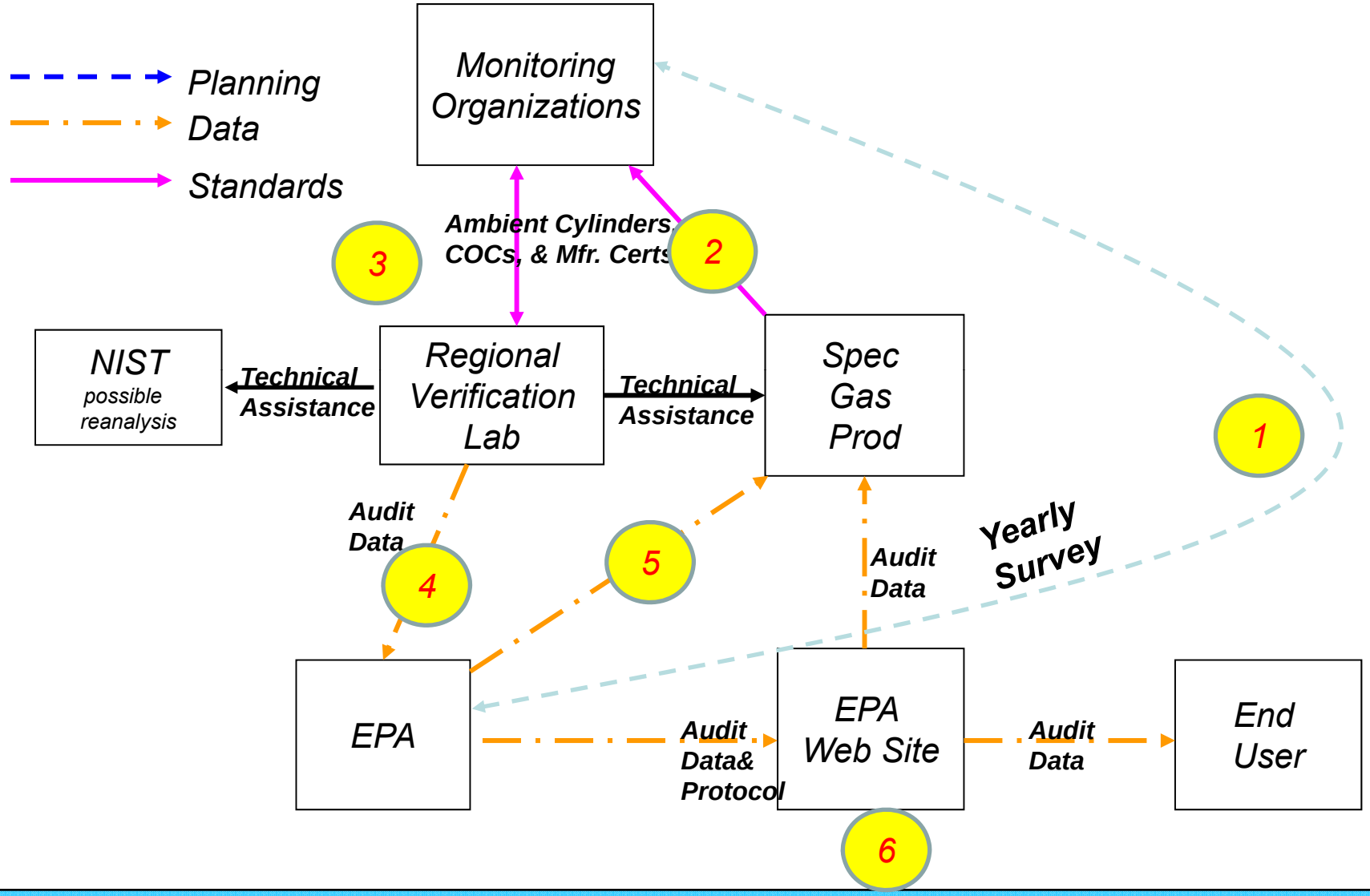
2.6.1 Gaseous Pollutant Standards

- Defined as SO_2, CO, NO and NO_2
- Traceable to an NIST standard or an NIST certified "gas manufacturer's internal standard"
- Certification to follow EPA Protocol gas Program defined in:
  - *EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards*, EPA-600/R-97/121, September 1997

TRACEABILITY –TO NIST

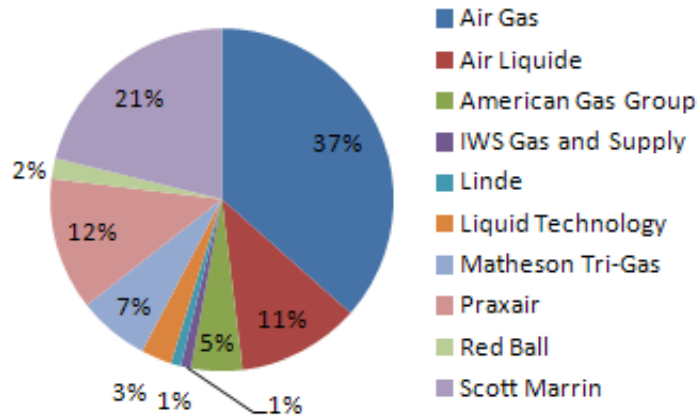
- Applies to the comparability of any US monitoring organization's reported value for one of its calibration standards to the equivalent NIST value
- Is about the component and total mean and variability of these values occurring as result of serial intercomparisons between a NIST standard and the organization's standard

Ambient Air Protocol Gas Verification Program



Ambient Air Protocol Gas Verification Program Annual Reports 2010 and 2011

Region 2 CO								
Date	Lab	Producer	Facility	Cylinder ID	Pollutant	Assay Conc	Producer Conc	% Bias
2/23/2011	2	Linde	Alpha, NJ	CC344529	CO	5005	4980	0.52
6/10/2011	2	Coastal	Beaumont, TX	CC300210	CO	2399.18	2410	-0.45
9/7/2011	2	Global	Palmetto, FL	EB0030422	CO	9003.45	8954	0.55
9/12/2011	2	American Gas Group	Toledo, OH	EB0024958	CO	194.91	195	-0.04
11/15/2011	2	Scott-Marrin	Riverside, CA	CC12477	CO	209.1	212	-1.27
11/16/2011	2	Praxair	Bethlehem, PA	FF37697	CO	38.49	38.9	-1.05
11/16/2011	2	Praxair**	QC Sample	SA6140	CO	5002.82	5007	-0.08
Region 2 SO2								
2/23/2011	2	Linde	Alpha, NJ	CC344529	SO2	51.06	51.1	-0.08
6/7/2011	2	AirGas	Durham NC	LL33617	SO2	44.62	43.91	1.61
6/7/2011	2	AirGas	Durham NC	CC349796	SO2	45.18	45.28	-0.23
6/7/2011	2	Air Liquide	Plumsteadville, PA	CLM006761	SO2	54.5	55.4	-1.62
6/7/2011	2	Praxair	Bethlehem, PA	FF28443	SO2	48.71	48.9	-0.39
6/15/2011	2	Praxair	Toledo, OH	CLM000306	SO2	40.88	41.1	-0.52
9/6/2011	2	Praxair	Bethlehem, PA	FF33213	SO2	40.82	41.2	-0.92
9/6/2011	2	Global	Palmetto, FL	EB0030422	SO2	44.93	45.9	-2.12
11/9/2011	2	Praxair	Bethlehem, PA	FF33837	SO2	48.56	49.3	-1.51
11/9/2011	2	Praxair**	QC Sample	SA6140	SO2	45.87	46.73	-1.83
11/9/2011	2	Praxair	Bethlehem, PA	FF33237	SO2	14.29	14.8	-3.43
11/9/2011	2	Scott-Marrin	Riverside, CA	CC12477	SO2	12.87	12.99	-0.9



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Appendix A in Half-a-Day

Flow Rate Standards *(2.6.3)*

- Must be made by a flow measuring instrument that is traceable to an authoritative volume or other applicable standard.

2.7 Requirements and Guidance

- Regulations
  - Must be followed
  - Usually minimum requirements
- Guidance
  - More details on regulations
  - Provides additional suggestions or strongly suggests
  - Are not mandatory, but you need an acceptable alternative

- EPA Regs
  - QA Policy
  - CFR Contracts and Grants
  - R2- QMP
  - R5 – QAPPs
  - 40 CFR Part 58 App A
  - 40 CFR Part 50 (Methods)
- Guidance
  - G2- QMP
  - G5-QAPP
  - QA Handbook Vol II
  - QA Handbook Volume IV
  - TADs, White Papers, etc

United States Environmental Protection Agency

Office of Air Quality Planning and Standards Research Triangle Park, NC 27711

EPA-DRAFT March, 1998 Air

EPA Quality Assurance Handbook for Air Pollution

United States Environmental Protection Agency

Office of Air Quality Planning and Standards Research Triangle Park, NC 27711

EPA-454/R-98-005 April, 1998

EPA Quality Assurance Guidance Document

Quality Assurance Handbook for Measurement

EPA United States Environmental Protection Agency

Technical Assistance Document (TAD) for Precursor Gas Measurements in the NCore Multi-pollutant Monitoring Network

Version 4

Guideline on the Meaning and the Use Of Precision and Bias Data Required by 40 CFR Part 58 Appendix A

Version 1.1

EPA United States Environmental Protection Agency

Office of Air Quality Planning and Standards

United States Environmental Protection Agency

Human Exposure and Atmospheric Sciences Division National Exposure Research Laboratory Research Triangle Park NC 27711

Research and Development

November 1998

EPA

Quality Assurance Guidance Document 2.12

Monitoring $PM_{2.5}$ in Ambient Air Using Designated Reference or Class I Equivalent Methods

Contents

Section	Title	No. of Pages
1.0	Scope and Applicability	5
2.0	Prerequisites	8
3.0	Summary	6
4.0	Procurement of Equipment and Supplies	8
5.0	Installation	3
6.0	Calibration Procedures	17
7.0	Filter Preparation and Analysis	19
8.0	Field Operation	12
9.0	Sampler Maintenance	5
10.0	Performance Evaluation Procedures	13
11.0	Calculations, Validations, and Reporting of $PM_{2.5}$ Monitoring Data	7
12.0	Data and Records Management	6
13.0	Assessment of Measurement Uncertainty for Monitoring Data	6
14.0	References	4
15.0	Index	3
Appendix		
A	Measuring Alkalinity of Filters	12

Sections 3.1- 3.3

3.1. PQAOs

3.2. Measurement Quality Checks for automated instruments

- gaseous monitors
- continuous PM

3.3. Measurement Quality Checks for manual methods

- PM and Pb

Section 3.1 PQAO: The Primary Quality Assurance Organization

- Is responsible for a set of stations that monitors the same pollutant and for which data quality assessments can logically be pooled and reported
- Does not have to be the old "Reporting Organization"; in fact, may consolidate two or more

Section 3.1 PQAO Characteristics

(a) Site operation by a common team of field operators according to a common set of procedures;

(b) Use of a common QAPP or standard operating procedures;

(c) Common calibration facilities and standards;

(d) Oversight by a common quality assurance organization; and

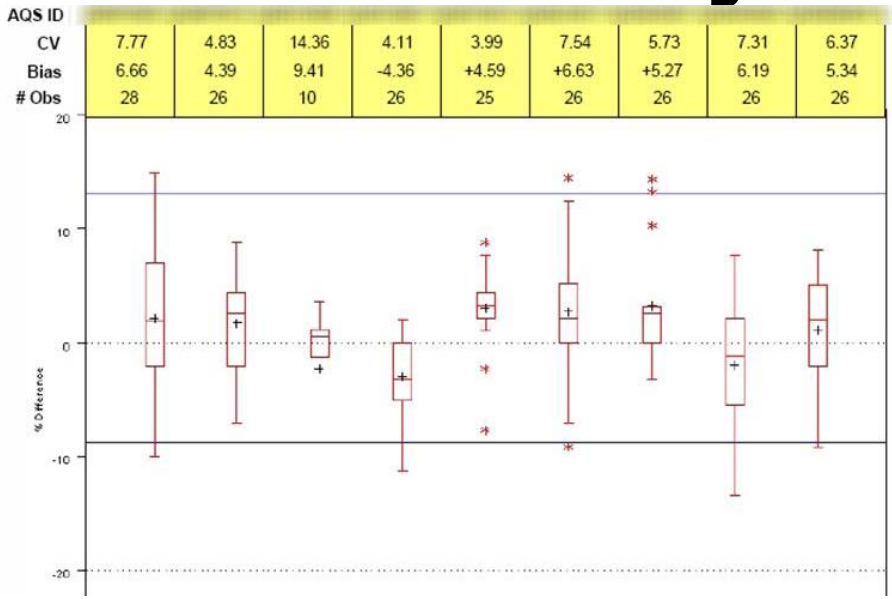
(e) Supported by a common management, laboratory or headquarters.

Section 3.2 Gaseous Pollutants

3.2.1 1-Point QC Checks

- Every two weeks-minimum
  - 0.01-0.1 ppm SO_2 NO_2, O_3
  - 1 -10 ppm CO

} Select QC concentration that's related to routine concentrations



Used to assess bias and Precision (talked about later)

Advantage of Automated 1 Pt. QC Checks

- Doing more than the minimum is fine
- Advantage is a more frequent flag alerting about problems and therefore minimizing the loss of good data

Issues for Generating and Analyzing Low Level Concentrations

- For 20% or less Full Scale1Point QC checks, recent trace level gas audit work has indicated problems with generating and analyzing that may be relevant
- O3 generators may not be designed to reliably and accurately provide the low points– issues for O3 and NO2/GPT?
- CO instability has been seen at low levels.
- Temperature variability may be a cause

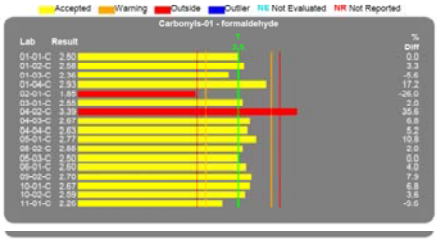
3.2.2Performance Evaluation-What, Why, Where

Performance evaluations (PEs) are a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst, or a laboratory. In a sense, an audit is a “blind” calibration, for which the concentrations are NOT KNOWN to the station operator, who uses the station calibration to say what he/she thinks the concentrations are.

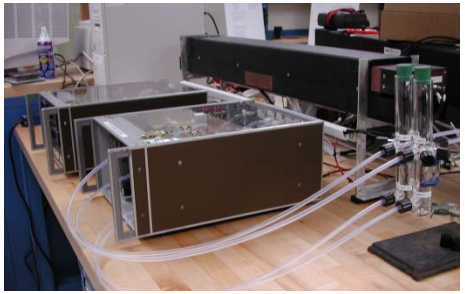
NPAP-TTP

PEP

Protocol Gas



NATTS PT &
ORIA Round Robins



SRP

PAMS Cylinders

What

- Section 3.2.2-Agency Requirements-Annual PE
- Relationship- 2.4 provides for independent quantitative verification of agency (3.2.2) implementation
- 3.2.2 goal is 100% of all sites per year, and to report 25% each quarter
- See the link at :

  http://www.epa.gov/ttn/amtic/npepqa.html

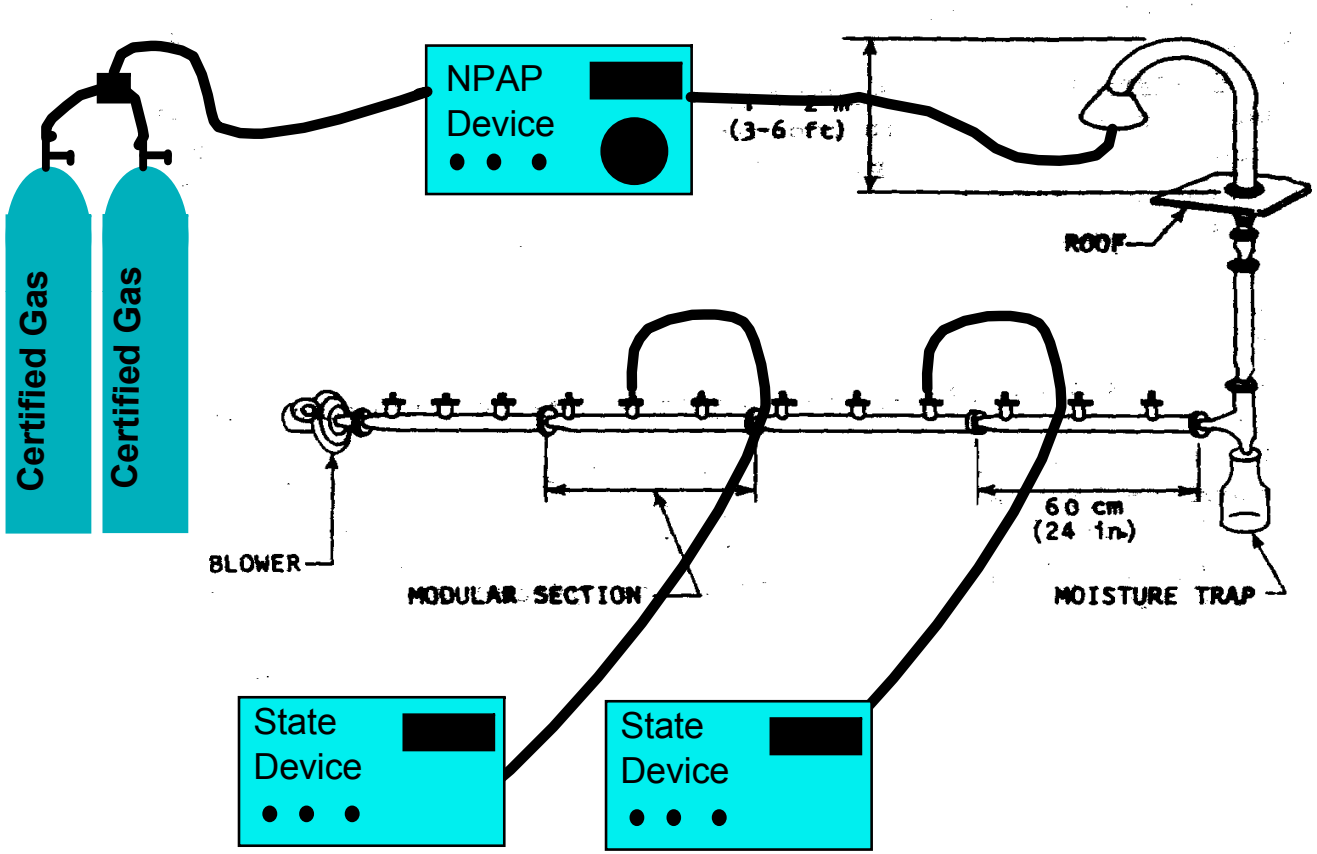
Why

- Independent check of the monitoring operation
- Independently quantifying the adequacy of the agency's station operator performance (how well are they doing the calibrations, etc.)
- Quantification of data comparability at an agency level

Where

- SLAMS sites
- SPM (& Tribal?) sites
  - Question: Does this mean ALL SPM (&Tribal?) sites? Answer: NO!
- PSD Sites (most permits are from agencies:
  - If permit requires pre- and/or post-construction monitoring.
  - YES, audits ARE required; agencies need to require industries to do it.

NPAP: Through the Sampling Inlet, or Probe (TTP)



3 TTP Mobile Platform Types

TTP Trailer Platform- Exterior Features

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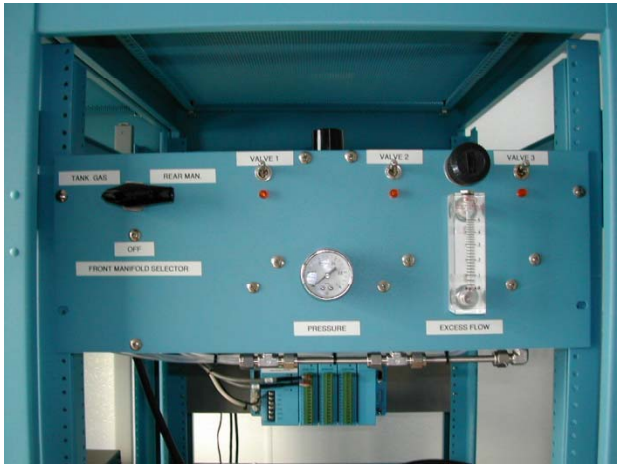
Appendix A in Half-a-Day

TTP Trailer Platform –Interior Features



One TTP Connection Set-up:

- The Teflon hose, enclosed in braided Stainless steel (Top), is from the audit trailer
- The teflon hose (left) goes to the site monitor
- The white hose (right) serves as a vent (needed due to effects of P on Concentration)

Some Station Access& Connections Are Easier

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Appendix A in Half-a-Day

Temporary Protection of the TTP Connection

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Appendix A in Half-a-Day

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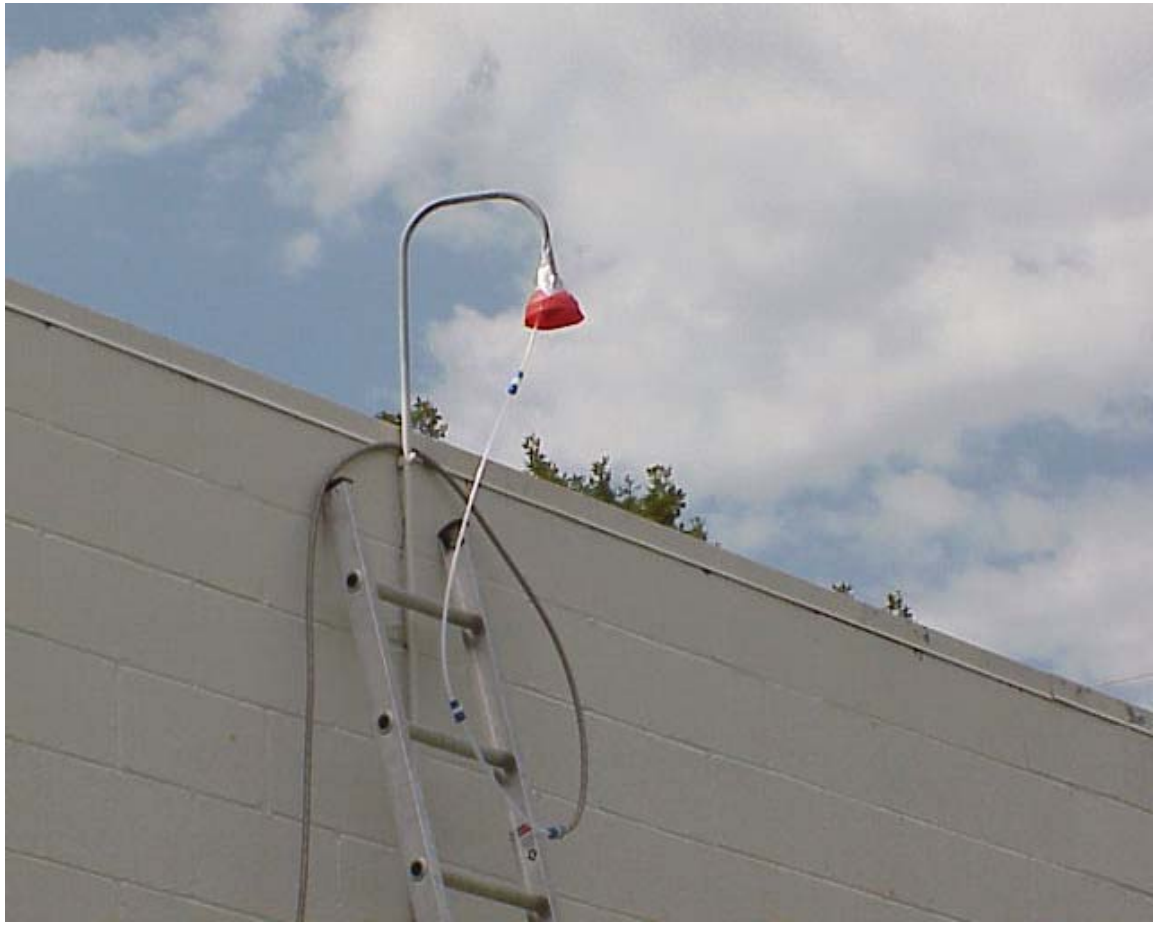
Appendix A in Half-a-Day

Inverted (Site) Rain Shield, No TTP Connection Vent Line



No Rain Shield

No Vent Line

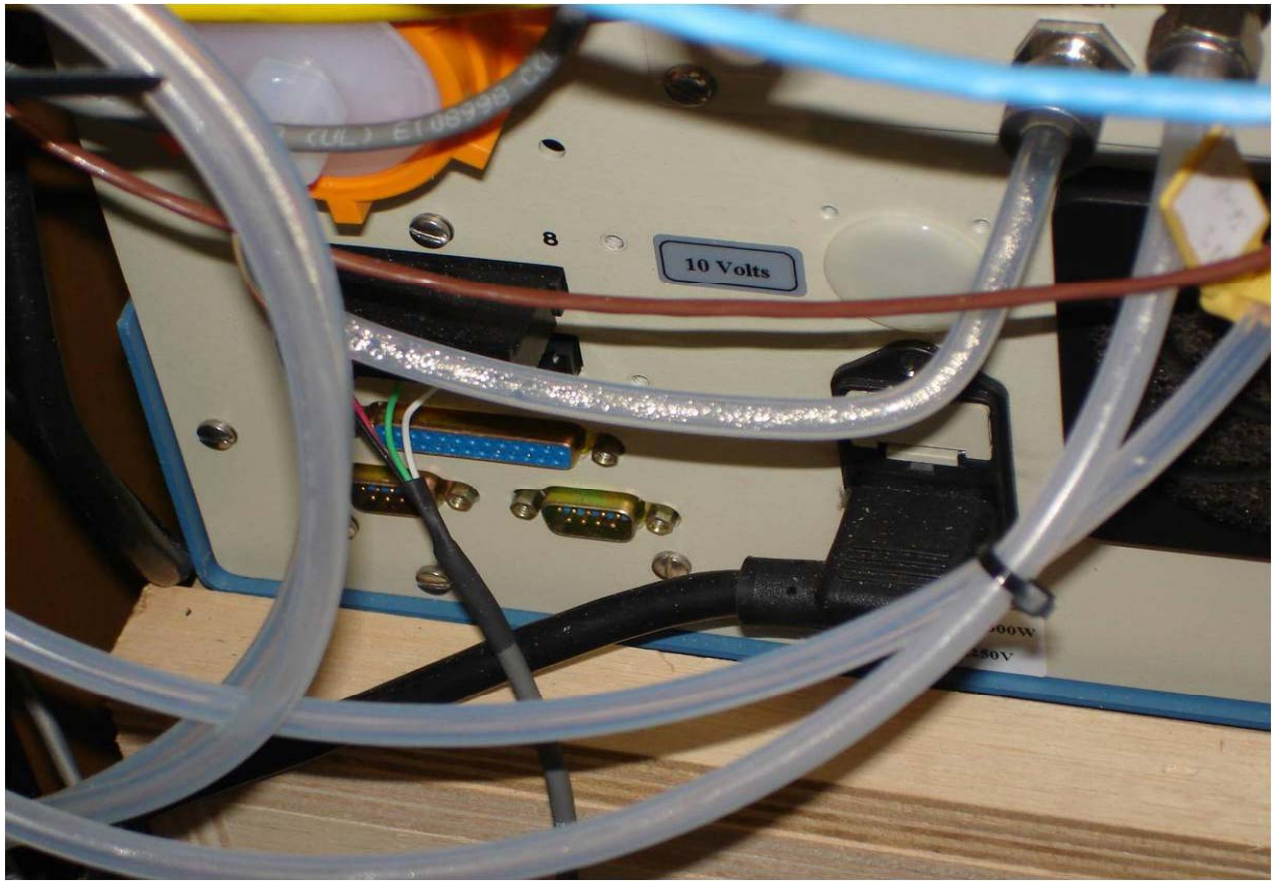
High-With Safety Harness

PROBLEMS NOTED AT SITES; or, WHY DO TTP?

There have been several findings that could lead to the reduction in significant problems during future audits.

- dirty manifold
- dirty connectors
- leaky joints
- difficult access
- dirty sample lines
- dirty particulate filter holders
-water in line

Water in Line



Dirt in Line

Sec. 3.2.2.2 Changes for Annual PE

- No good deed goes unpunished
- Agency choices for audit ranges were expanded to provide flexibility as typical values go lower
- AQS reporting requires 3 digits
- Majority of new ranges have 2 digits in their ranges
- Result: gaps between some ranges

New Challenges: Changes in Agency PE Requirement

Currently in CFR: note audit level gaps

AUDIT LEVEL	CONCENTRATION RANGE, ppm			
	O3	SO^2	NO^2	CO
1…	0.02 – 0.05	0.0003-0.005	0.0002-0.002	0.08 – 0.10
2…	0.06 – 0.10	0.006 – 0.01	0.003 – 0.005	0.50 – 1.00
3…	0.11 – 0.20	0.02 – 0.10	0.006 - 0.10	1.50 – 4.00
4...	0.21 – 0.30	0.11 – 0.40	0.11 – 0.30	5 – 15
5...	0.31 – 0.90	0.41 – 0.90	0.31 – 0.60	20 - 50

Nov 2010 Audit Levels

Interim Guidance, on AMTIC, with new table, 10 levels, 3 digits

No concentration gaps

Audit Level	Concentration Range, ppm			
	O3	SO2	NO2	CO
1	0.004-0.0059	0.0003-0.0029	0.0003-0.0029	0.020-0.059
2	0.006-0.019	0.0030-0.0049	0.0030-0.0049	0.060-0.199
3	0.020-0.039	0.0050-0.0079	0.0050-0.0079	0.200-0.899
4	0.040-0.069	0.0080-0.0199	0.0080-0.0199	0.900-2.999
5	0.069-0.089	0.0200-0.0499	0.0200-0.0499	3.000-7.999
6	0.090-0.119	0.0500-0.0999	0.0500-0.0999	8.000-15.999
7	0.120-0.139	0.1000-0.1499	0.1000-0.2999	16.000-30.999
8	0.140-0.169	0.1500-0.2599	0.3000-0.4999	31.000-39.999
9	0.169-0.189	0.2600-0.7999	0.5000-0.7999	40.000-50.000
10	0.189-0.259	0.8000-1.000	0.8000-1.000	50.000-60.000

http://www.epa.gov/ttn/amtic/files/ambient/pm25/datamang/TechMemoforPEAuditLevels.pdf

Additional Changes Needed for Trace Level (TL) Audits

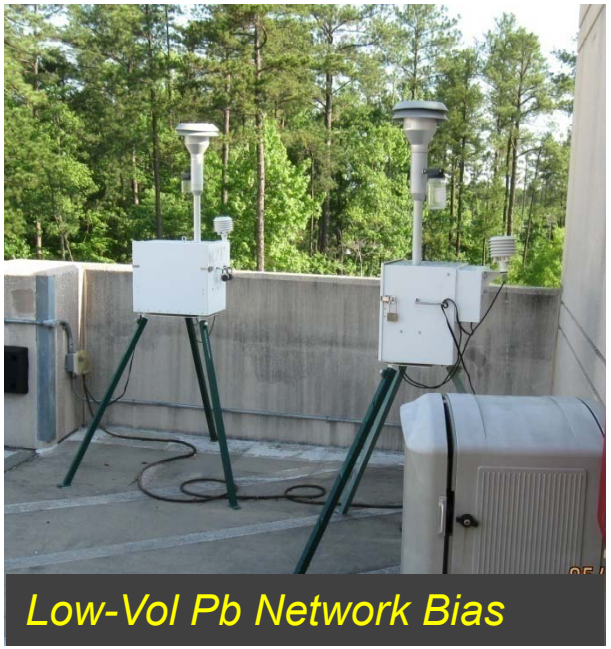
- "New Math" for New Audit Acceptance Limits
  - For the lowest 2 new audit levels (1 and 2), old % Difference won't work
  - For O3, SO2 and NO2, +\- 1.5ppb D or 15% D, whichever is greater
  - For CO,+/-0.3ppm or 15%,whichever is greater
- These values are based on current data; as we get more data, they may change
- Technical guidance memo on AMTIC

http://www.epa.gov/ttn/amtic/files/ambient/pm25/datamang/20110217lowlevelstatmemo.pdf

3.2.2.2.a & 3.2.2.3 vs 3.2.2.4-Technical Issues

- 3.2.2.2.a.Audit for NO2 by GPT, requires 80ppb remaining; what about for Low or Trace Level NO2, NOy?
- 3.2.2.3 audit requires same flow path as for monitoring (e.g., filter);it's a monitor
- 3.2.2.4 requires a standard
- For O3, monitor would have a filter on its inlet
- For O3,standard should have the same zero air as the generator-so, no filter, may need some re-plumbing.

Section 3.2.3 -3.3.8: PM and Pb QA



Section 3.2.3 & 3.2.4 PM Flow Rate Verifications and Audits

- Designed to indicate **sources** of bias or relative inaccuracy—
  - *The **cut point of the PM separators** (size of the particles collected) are entirely dependent on the flow rate (actually velocity)*
  - ***Sampled Air Volume** (as determined by the sampler from apparent flow rate) is a key parameter for the calculated pollutant concentration*
- So, Verifications
  - Performed by operators
  - Monthly basis
- Audits
  - Independent auditors or at least with independent, **NIST-**traceable standards Look at new validation templates
  - Semi-annually or quarterly
  - Results reported to AQS for data certification and AMP 255 Report

You might ask "why?"

Section 3.2.5-3.2.6 $PM_{2.5}$ and $PM_{10-2.5}$ Collocation Requirements--General

- Why do we want to collocate samplers
  1. There is no single physical reference standard material or measuring device for (any form of) PM.
  2. Therefore the only way to gain some level of confidence in a measurement is to insure the sampler or monitor is performing within design specifications and there is an independent check on its ability to reproduce the results that it achieves.
  3. We use collocation to perform this precision or relative bias measurement – ***A couple of things to remember***
  4. ***A collocation sampler used for precision must be of identical make, design and operation (e.g., WINS to WINS; VSCC to VSCC)***
  5. ***Generally, a collocation sampler that is not identical to the primary sampler can only provide a relative bias***
     - ✓ ***If this measurement is repetitive a precision like relationship between the measures can be established***

Section 3.2.5-3.2.6 $PM_{2.5}$ and $PM_{10-2.5}$ Collocation Requirements--General

- What is a collocated sampler?
  - Any sampler placed beside a primary sampler for measurement or collection of data that can be related or compared to that of the primary sampler
- Begs the Question: What is a primary sampler?
  - Sampler that produces ambient concentration data for determining environmental impacts such as compliance with NAAQS or other regulatory requirements
- So, **First** **Designate Primary** and then,
  - select collocated sampler

Section 3.2.5-3.2.6: Automated $PM_{2.5}$ and $PM_{10-2.5}$ Collocation Requirements

$PM_{2.5}$ Collocation Per PQAO	$PM_{10-2.5}$ Collocation Based on National Network
15% of network (at least 1 per PQAO)	15% of National network; at least 2 if network <10
First must be an FRM with same method designation; Second with same method designation	
FEMs 50% with FRM; 50% with same method designation; Odd number produces 1 extra FRM	FEM collocations are directed by EPA Regional Administrator
Siting 80% at sites 20% NAAQS or 60% at highest 25% of sites	Selected by Region
Calibrations on Primary Schedule	Calibrations on Primary Schedule

Manual $PM_{2.5}$ and $PM_{10-2.5}$ Collocation and PEP Requirements

Collocation: Sections 3.3.5-3.3.6 are the same as Sections 3.2.5-3.2.6

PEP: Sections 3.3. 7-3.3.8 are the same as Sections 3.2.7-3.2.7

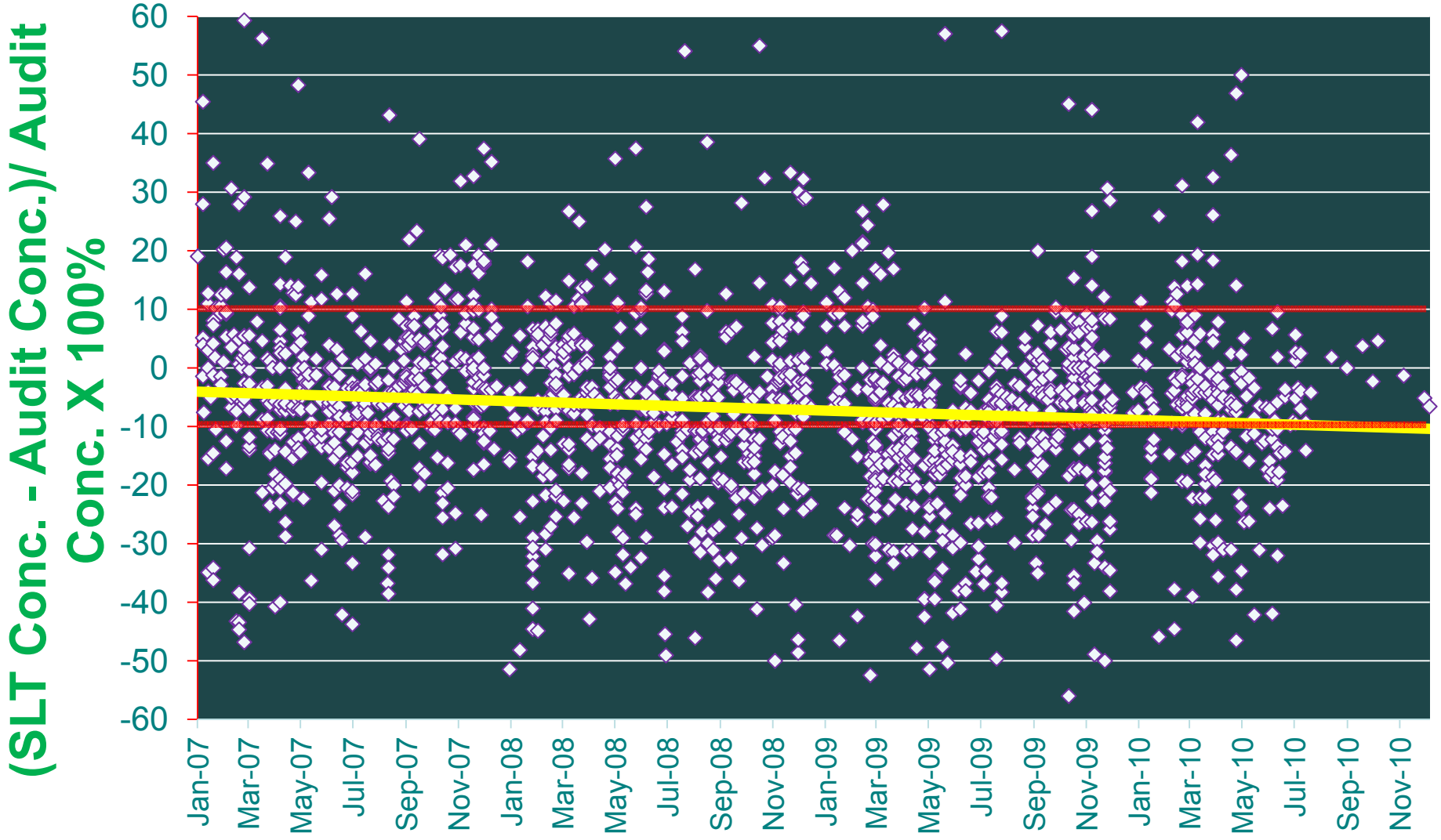
Section 3.2.7: $PM_{2.5}$ FRM/FEM Performance Evaluation Program

- **Collocates** an **independent** FRM audit sampler **beside a FRM/FEM**
- Applies **rigorous performance and QA/QC requirements** to field and laboratory operations
- Provides **independent assessment** of **network sampler bias** ***Recall DQO = <10% over 3 years***
- Provides **audits** of State/local/Tribal FRM measurements ***Retrospective Only!!!***

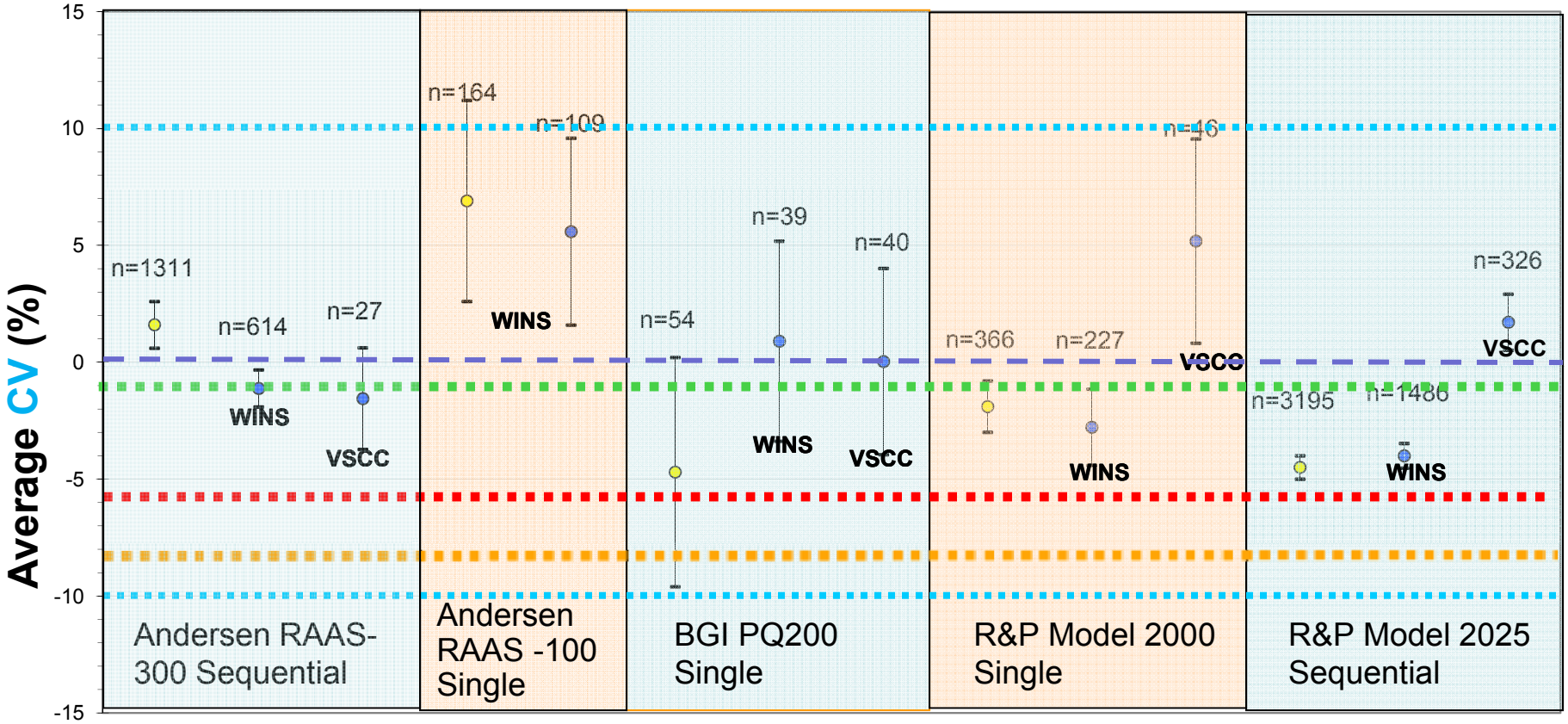
$PM_{2.5}$ FRM/FEM Performance Evaluation Program

- **PEP Requirements a/o Jan 07 for Each PQAO:**
  - **15% of all sites audited per year**; all sites in 6 years
  - If **5 sites or less-----5 audits per year**
  - If **>5 sites-----8 sites per year**
  - **At least one of each "monitor type" audited each year, including "regulatory" FEMs and SPMS**

Percent Difference Over Time



Comparison of 95% Confidence Intervals for 1999 thru 2009 National Bias Estimates



- ***Average** CV for 2007 - 2009*
- ***Average** CV for 1999 - 2004*

All Concentrations ≥ 3 µg/m³

Method Designation

Target DQO ± 10%

99-07 Avg all samplers
2008 Avg all samplers
2009 Avg all samplers

Section 3.3.1 QA for PM_{10}

Collocation (precision) Requirements

- **15% of sites in PQAO**
- **Hi-vols TSP cannot be Surrogate Primary samplers for PM_{10} Hi-vol samplers**
- **$PM_{10-2.5}$ Primary Samplers may Constitute a Primary PM_{10} Sampler**
- **Hi-vol Pb and TSP may serve as collocations against each other**
  - **Total Mass of TSP/Pb filter must be measured before chemical analysis for Pb**

Section 3.3.2-3.3.3 PM_{10}

Flow Rate Verifications and Audits

- **Verifications are the same for all PM & Pb samplers**

  Low Vols monthly, But Hi-Vols Quarterly

- **Audits are Semi-annual across the board**
  - **Special note on Hi-vols with flow controllers**

    Use a routine filter for flow verfications and audits, when using MFC'd Samplers

Section 3.3.4 Lead (Pb)
FRM/FEM QA

Flow verifications and Audits follow PM procedures

Pb Strips for Lab Proficiency Tests

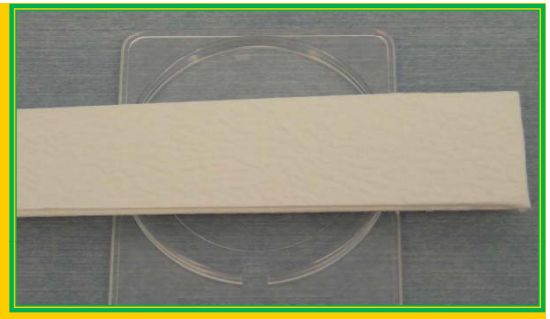
- **Quarterly**
- **Strips prepared by depositing a Pb solution on unexposed glass fiber filter strips of dimensions 1.9 centimeters (cm) by 20.3 cm (3⁄4 inch by 8 inch)**
- **<u>Must Be Independent</u> of analytical lab calibration Strips**
  - **Two Concentration Ranges**

Pb Analytical Lab PT Strip spikes

Range	Percent of NAAQS	Pb Concentration, µg/ strip	Equivalent ambient Pb concentration, µg/m3
1 .. *Based on Old Pb NAAQS*	100-300	100–300	0.5–1.5
2 ..	400-1000	400–1,000	3.0–5.0
1 .. *For the New Pb NAAQS*	30-100	(37%)* 12.29	0.0555
2 ..	200-300	(213%)* 71.11	0.3200

**Actual concentrations may vary slightly from year to year*

Ordering Pb Strips for Your Own Lab's QC Analysis



- EPA has set up a Work Assignment w/RTI to prepare Audit Strips for Analytical Labs
- **Must Notify Mike Papp by August 31 of every year** to be put on the list to receive (papp.michael@epa.gov)
- RTI has exhausted supply for 2012

Section 3.3.4.3 Lead (Pb) FRM/FEM Collocated Sampling

- **Same philosophy as PM-10**

- **<u>High volume sites</u>**
  - **15% of all sites collocated per PQAO per year;**
    <u>or at least 1</u>
  - **First site should be highest concentration site**
    - ✓ **Alternate can be approved by EPA RA**
  - **1-Year Airport sites are included in the PQAO's network**
    - ✓ Not explicitly required to be collocated (or audited)
    - ✓ Consider the consequences if not!!
  - **NCore TSP sites are considered as ordinary Pb sites**

Except: If the only TSP site in PQAO is NCore, No Collocation!!

Section 3.3.4.3 Lead (Pb) FRM/FEM Collocated Sampling

- **Low-vol PM-10 requirements are complex**
  - By definition in Pb rule LV sites not in NCore are considered part of the SLT/PQAO's Pb network
  - 15% of all source or non-source sites collocated per PQAO per year; **or at least 1 of all method codes**
  - **NCore Network is a PQAO by itself**
  - Approximately 20 NCore sites have been up-fitted with PM-10 samplers for Pb
  - Approximately 5 sites have been selected for collocation

Section 3.3.4.4 Lead (Pb) FRM/FEM Performance Evaluation Program

- **High Volume Pb PEP Requirements Per PQAO:**

- **Same philosophy as $PM_{2.5}$**
  - **15% of all sites audited per year**; all sites in 6 years
  - **If 5 sites or fewer ► 5 Audits per year**
    - ***1 with an independent PEP sampler***
    - ***4 filters collected from network precision samplers and sent to EPA's Independent lab***
  - **If 5 sites or more ► 8 audits per year**
    - ***2 collocations with an independent PEP Sampler***
    - ***6 filters collected from network precision samplers***
  - **At least one of each "monitor type" audited each year, including: "regulatory" FEMs and SPMS; and temporary Airport sites**

Section 3.3.4.4 Lead (Pb) FRM/FEM Performance Evaluation Program

- **What about Low Volume PM-10 Sites--NCore**

- **1 or 2 independent audit every year applies**
- **but we are simplifying the choices because of the design of the NCore Network !**
- **Every Region that has at least one NCore low-volume PM-10 Pb site will conduct one independent PEP audit at one site per year**
  - **Any other designated non-source-oriented site will be included and be audited at least once in six years**

Section 3.3.4.4 Lead (Pb) FRM/FEM Performance Evaluation Program

- **What about Low Volume PM-10 Sites--NCore**

- **SLT Collocated Samples to be submitted to PEP lab (initially EPA, RTP, NC)**
  - **by every collocated site (5 across the network)**
  - **once per quarter**

Section 3.3.4 Lead (Pb)

Summary Table of Collocation and PEP Requirements

Pb Sampler in network	Host PQAO	No. Collocation sites.	No. Independent PEP Audits	No. Colloc. filters to EPA
TSP	SLT	15% or at least one	1 or 2; all in 6 yrs	4 or 6 spread by site and qtr.
TSP NCore	SLT	If only SLT TSP site, "0"	Include in SLT PQAO	Covered by SLT PQAO Requirements
TSP Airport	SLT	Optional-part of PQAO	Include in SLT PQAO	Optional unless only SLT PQAO Site
PM-10 Low Vol	SLT	15% or at least one	Include with respective Region's NCore PQAO Rotation	1 filter per site per qtr.
PM-10 Low Vol NCore	NCore	15% (see below) 3 based on current site count	Every Region with site conducts 1 per year; all in 6 yrs	Covered by 5 NCore Colloc. sites
PM-10 Low Vol NCore Collocated	NCore	5 sites have been approved a/o Jan 2012	First year and in the Regional 6 yr Rotation thereafter	1 filter per site per qtr.

Section 3.3.4 Lead (Pb) FRM/FEM Performance Evaluation Program

- **Analytical methods**

- **ICP-MS FEM for high volume samples due to sensitivity for lower concentrations**
- **XRF for Low volume sampler filters, because it is the FRM**
- **ICP-MS FEM for low volume 47mm PTFE filters is near publication**
  - **Uses aggressive extraction solution with HF**
  - **PEP will stick with XRF until ICP-MS is widely adopted**

What happens When the Ambient Concentration Gets Small

Practical minimum limits on the DQOs for PM Methods

- **At certain concentrations the statistics do not provide very meaningful results for Collocated Samplers or PEP measurements**

  (1) TSP: 20 µg/m3.

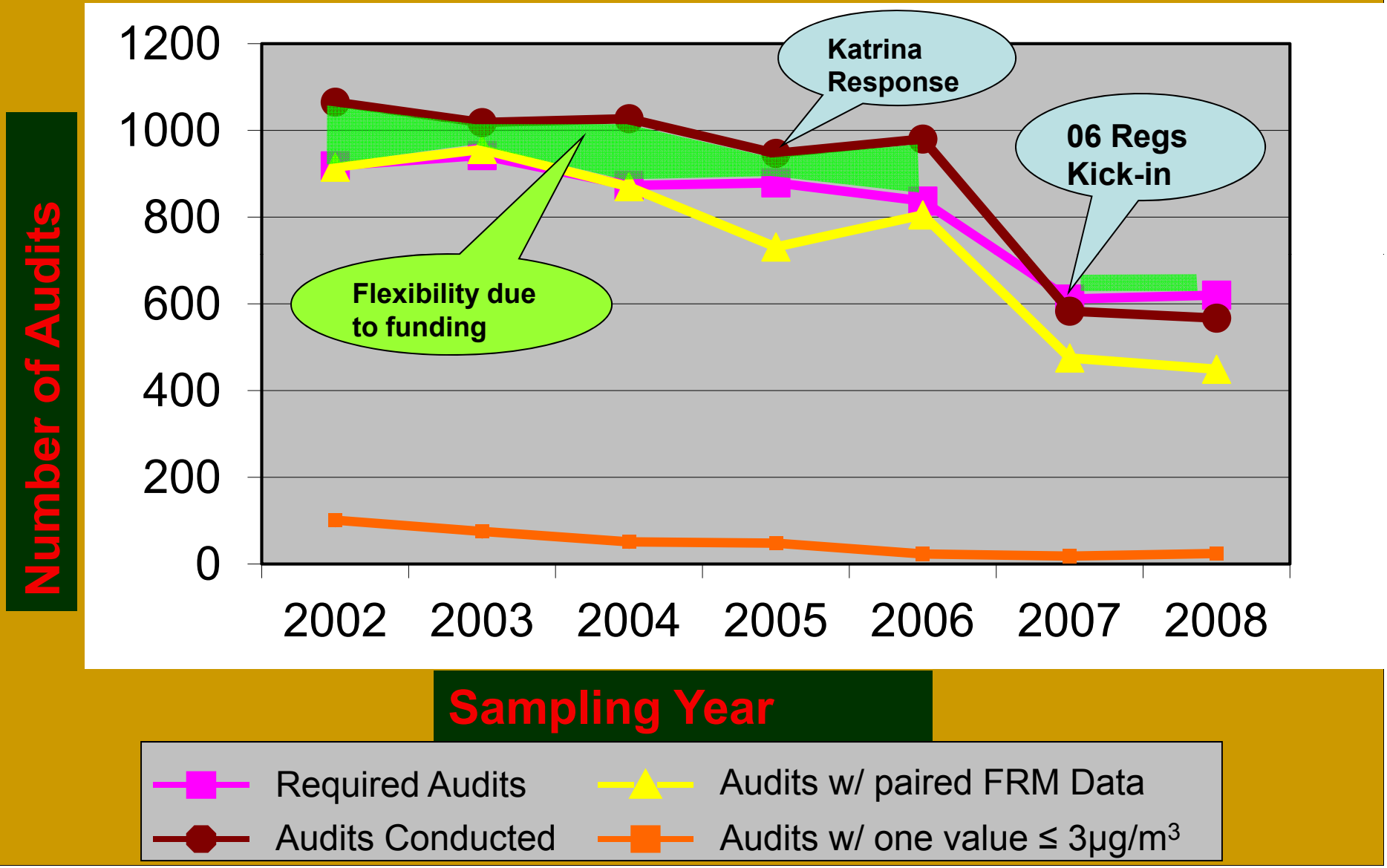
  (2) Pb: 0.02 µg/m3.

  (3) PM10 (Hi-Vol): 15 µg/m3.

  (4) PM10 (Lo-Vol): 3 µg/m3.

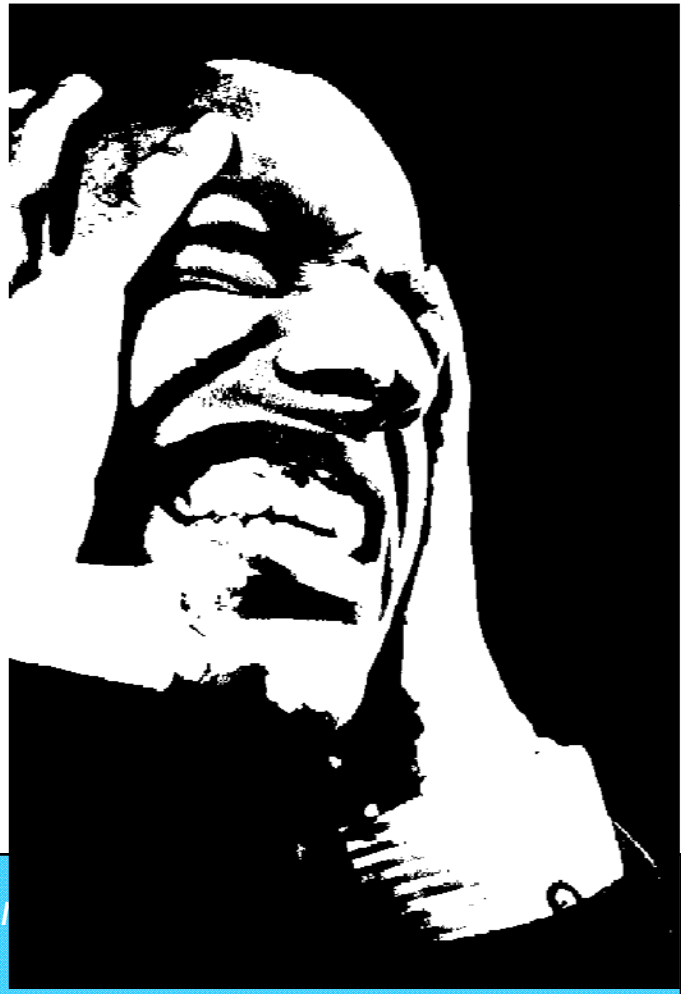
  (5) PM10–2.5 and PM2.5: 3 µg/m3.

$PM_{2.5}$ PEP History at a Glance



Appendix A: Calculations for Data Quality Assessment

- **QC check statistics**
- **Precision calcs**
- **Bias calcs**
- **PM stats**
- **Reporting: quarterly and annual**



AMP 255 Report

Quarterly

Yearly

3 Years

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
DATA QUALITY INDICATOR REPORT
1-Point Quality Control

DASC

Anytime

O_3 Assessments

Site ID: (Enter Site ID)	Pollutant type: O_3	CV_{ub} (%)	Bias (%)

Meas Val (Y)	Audit Val (X)	d (Eqn. 1)	25th Percentile	d^2	|d|	|d|^2
87	81	7.407	54.870	7.407	54.870	

"AB" (Eqn 4) 6.534

"AS" (Eqn 5) 1.026

Bias (%) (Eqn 3) 7.38

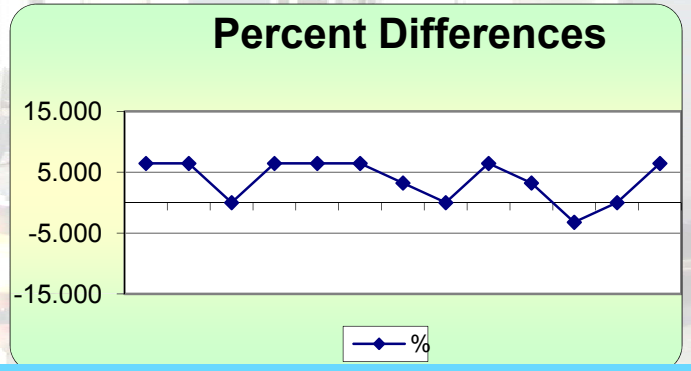
Both Signs Positive TRUE

CV (%) (Eqn 2) 1.81

Signed Bias (%) +7.38

Both Signs Negative FALSE

Upper Probability Limit	Lower Probability Limit
8.54	4.52



Part 1-ozone precision

What do you need to know about how the routine QC checks (~90 per qtr if done nightly) are used? How should YOU use them?

Sections 4 and 5—Use the DASC Tool to Understand Your QC Checks and Audit Results (like EPA does)

- Calculations of measurement uncertainty are carried out by EPA, *and* PQAOs should report the data for all appropriate measurement quality checks
- YOU do these calculations and charts easily, and save yourself time, money, and embarrassment

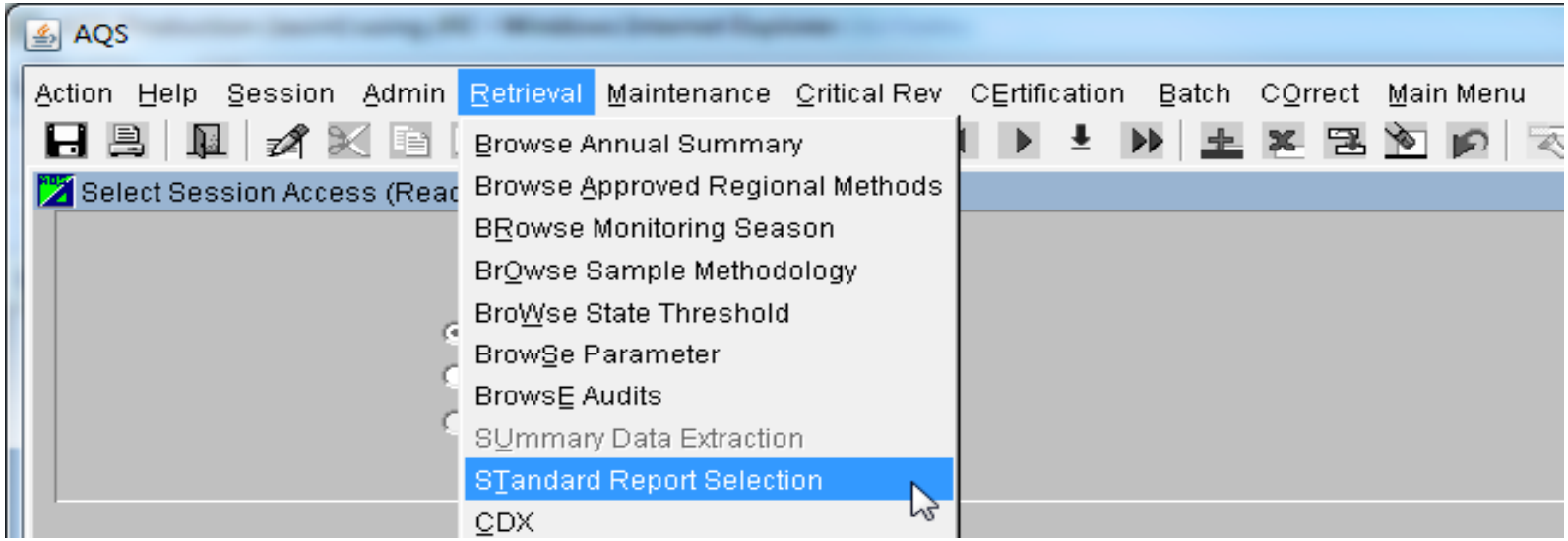
We will review each in both the DASC tool and the AMP255 report

First, what is the DASC tool?

- *DASC tool was produced specifically for us to calculate the data assessment statistics in CFR* in AMTIC Quality Indicator Assessment Reports (AMP255)
- **http://www.epa.gov/ttn/amtic/qareport.html**
- Easy way to explain and calculate data assessment statistics in CFR
- Excel spreadsheet
- *Matches AMP255 (by site)*
- *Each equation is numbered and matches the numbers in CFR*

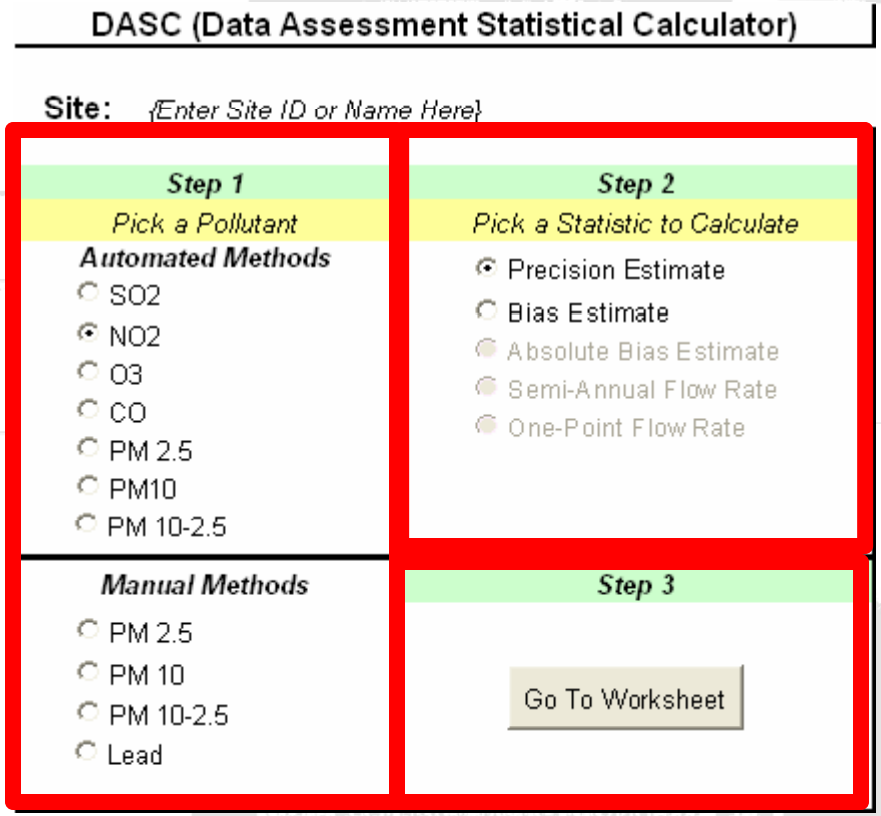
What is the AMP255-Data Quality Indicators Report?

- AQS Standard Report to Compute the Statistics Outlined on 40 CFR Part 58 Appendix A
- Part of the Annual Certification Process to Verify Submission of QA and routine Data to AQS



- CORRESPONDS to what you calculate in the DASC tool
- But 1st let's review the helpful DASC file:

Data Assessment Statistical Calculator (DASC)



Contains 12 different worksheets including menu

Understanding the Terminology

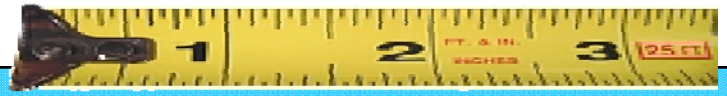
- "Meas" is the concentration indicated by the monitoring organization's instrument
- "Audit" is the audit standard used in the QC check being measured, or "known" value

Calibrations Results for Fourth Quarter 2011

Date	Monitor	Units	ZRef	ZMeas	SRef	SMeas	Zero	Factor	SDiff%	ZStd	SStd	Status
10/2/2011 2:57 AM	O3	ppm	0.000	0.001	0.081	0.080	0.001	1.019	-1.2	0.000	0.000	Valid
10/4/2011 2:57 AM	O3	ppm	-0.001	0.001	0.081	0.080	0.001	1.016	-1.2	0.000	0.000	Valid
10/6/2011 2:57 AM	O3	ppm	-0.001	0.000	0.081	0.081	0.001	1.005	0.0	0.000	0.000	Valid
10/8/2011 2:57 AM	O3	ppm	-0.001	0.001	0.081	0.081	0.002	1.014	0.0	0.000	0.000	Valid
10/10/2011 2:57 AM	O3	ppm	0.000	0.001	0.081	0.081	0.001	1.008	0.0	0.000	0.000	Valid
10/12/2011 2:57 AM	O3	ppm	0.000	0.001	0.081	0.081	0.001	1.027	0.0	0.000	0.000	Valid
10/14/2011 2:57 AM	O3	ppm	0.000	0.001	0.081	0.081	0.001	1.013	0.0	0.000	0.000	Valid
10/16/2011 2:57 AM	O3	ppm	-0.001	0.001	0.081	0.081	0.002	1.011	0.0	0.000	0.000	Valid
10/18/2011 2:57 AM	O3	ppm	0.000	0.001	0.081	0.081	0.001	1.011	0.0	0.000	0.000	Valid
10/20/2011 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.084	0.002	0.971	3.7	0.000	0.000	Valid
10/22/2011 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.086	0.002	0.947	6.1	0.000	0.000	Valid
10/24/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.952	6.0	0.000	0.000	Valid
10/26/2011 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.086	0.002	0.947	4.8	0.000	0.000	Valid
10/28/2011 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.086	0.002	0.950	4.8	0.000	0.000	Valid
10/30/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.086	0.003	0.958	4.8	0.000	0.000	Valid
11/1/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.940	7.4	0.000	0.000	Valid
11/3/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.088	0.003	0.941	7.3	0.000	0.000	Invalid
11/5/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.942	6.0	0.000	0.000	Valid
11/7/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.955	6.0	0.000	0.000	Valid
11/9/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.944	7.4	0.000	0.000	Valid
11/11/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.946	7.4	0.000	0.000	Invalid
11/13/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.939	7.4	0.000	0.000	Invalid
11/15/2011 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.087	0.002	0.948	6.0	0.000	0.000	Valid
11/17/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.949	6.0	0.000	0.000	Valid
11/19/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.941	7.4	0.000	0.000	Invalid
11/21/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.943	7.4	0.000	0.000	Valid
11/23/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.088	0.003	0.944	7.3	0.000	0.000	Valid
11/25/2011 2:57 AM	O3	ppm	-0.003	0.000	0.082	0.087	0.003	0.945	6.0	0.000	0.000	Valid
11/27/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.951	6.0	0.000	0.000	Valid
11/29/2011 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.087	0.002	0.944	6.0	0.000	0.000	Valid
12/1/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.086	0.003	0.961	4.8	0.000	0.000	Valid
12/3/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.956	6.0	0.000	0.000	Valid
12/5/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.948	7.4	0.000	0.000	Valid
12/7/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.086	0.003	0.961	4.8	0.000	0.000	Valid
12/9/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.942	7.4	0.000	0.000	Invalid
12/11/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.950	6.0	0.000	0.000	Valid
12/12/2011 2:42 PM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.952	6.0	0.000	0.000	Valid
12/13/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.086	0.003	0.949	6.1	0.000	0.000	Valid
12/15/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.086	0.003	0.957	6.1	0.000	0.000	Valid
12/17/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.086	0.003	0.953	6.1	0.000	0.000	Valid
12/19/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.086	0.002	0.958	4.8	0.000	0.000	Valid
12/21/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.087	0.003	0.945	7.4	0.000	0.000	Valid
12/23/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.086	0.003	0.954	6.1	0.000	0.000	Valid
12/25/2011 2:57 AM	O3	ppm	-0.002	0.001	0.082	0.087	0.003	0.949	6.0	0.000	0.000	Valid
12/27/2011 2:57 AM	O3	ppm	-0.002	0.001	0.081	0.086	0.003	0.951	6.1	0.000	0.000	Valid
12/29/2011 2:57 AM	O3	ppm	-0.003	0.001	0.082	0.087	0.004	0.954	6.0	0.000	0.000	Valid

GAS QC check precision statistics (CFR App A, 4.1)

- All statistics start from the difference between your instrument's indicated value and the known (audit) value (meas-known)/known= $\mathbf{d_i}$
- Both precision (wiggle) and bias (jump) are calculated from $\mathbf{d_i}$
- EPA calculates **precision** from these checks both by site and by PQAO
- These QC checks are then aggregated into "**upper bound of the CV**" for site and for PQAO
- The annual PE and NPAP results are used to *verify* the precision CVs

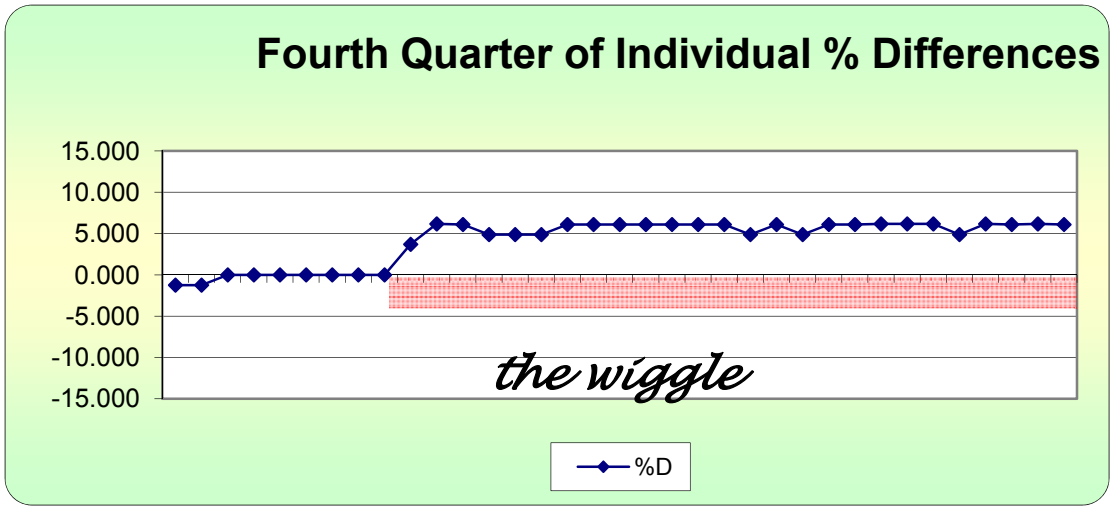


DASC tool will plot these values for you in control charts:

Meas Val (Y)	Audit Val (X)	d (Eqn. 1)
0.08	0.081	-1.235
0.08	0.081	-1.235
0.081	0.081	0.000
0.081	0.081	0.000
0.081	0.081	0.000
0.081	0.081	0.000
0.081	0.081	0.000
0.081	0.081	0.000
0.081	0.081	0.000
0.084	0.081	3.704
0.086	0.081	6.173
0.087	0.082	6.098
0.086	0.082	4.878
0.086	0.082	4.878
0.086	0.082	4.878
0.087	0.082	6.098
0.087	0.082	6.098

CV (%) (Eqn 2)

3.27



GAS QC check precision (cont.)

- You can be **90% sure that your true precision is less than** this "upper bound of the CV"
- Guidance: *each* $\mathbf{d_i}$ should be <7% for O_3, 10% for other gasses
- Then calculate your ***overall* CV** (based on many $\mathbf{d_i}$) by using DASC
- From DASC we see:

CV (%) (Eq'n 2)
3.27

- Corresponds to **CV** in AMP255 (EPA calculates both for each site and for your whole PQAO network)

DATA QUALITY INDICATOR REPORT

1-Point Quality Control

O3 **PQAO:** 1136 (Washington State Department Of Ecology)

Region	State	Site ID	POC	MT	Begin Date	End Date	# Req	# Obs	% Complete	CV	Bias
10	WA	53-053-0012	1	S	01-OCT-11	31-DEC-11	6	35	100	3.27	+ 5.05

Summary of precision:

- Calculated from routine QC checks d_i
- each check should be < 7% for O3, 10% other gasses
- Overall upper bound of CV calculated from d_i
- you can be **90% sure that your true precision is less than** this "upper bound of the CV"

Thanks Shelly Eberly!

Part 2-ozone bias

What do you need to know about how the routine QC checks (~90 per qtr if done nightly) are used? How should YOU use them, for BIAS?

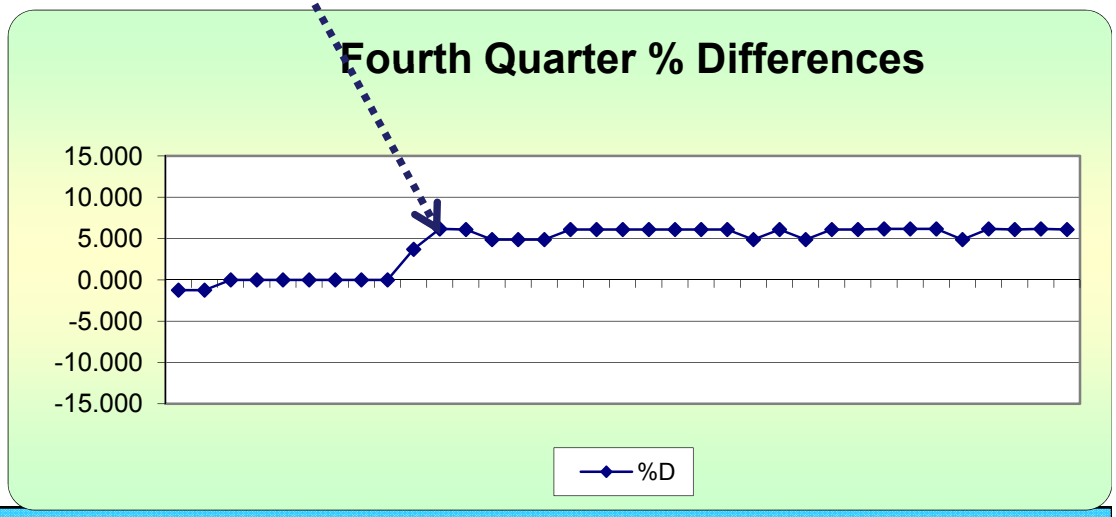
Bias statistics (CFR App A, 4.1.3):

- Remember that bias as well as precision starts from the difference between your instrument's indicated value and the known (audit) value (meas-known)/known= d_i
- bias (jump) is calculated from d_i
- Bias just *based on* the AVERAGE of the d_i with the sign taken into account (if your analyzer is always higher than the known, you have a high (+) bias

Bias is in DASC tool in the same sheet as precision (O3 P&B) and uses the same input:

Meas Val (Y)	Audit Val (X)	d_i (Eqn. 1)
0.08	0.081	-1.2
0.08	0.081	-1.2
0.081	0.081	0.0
0.081	0.081	0.0
0.081	0.081	0.0
0.081	0.081	0.0
0.081	0.081	0.0
0.081	0.081	0.0
0.081	0.081	0.0
0.084	0.081	3.7
0.086	0.081	6.2
0.087	0.082	6.1

Signed Bias (%)
+5.05



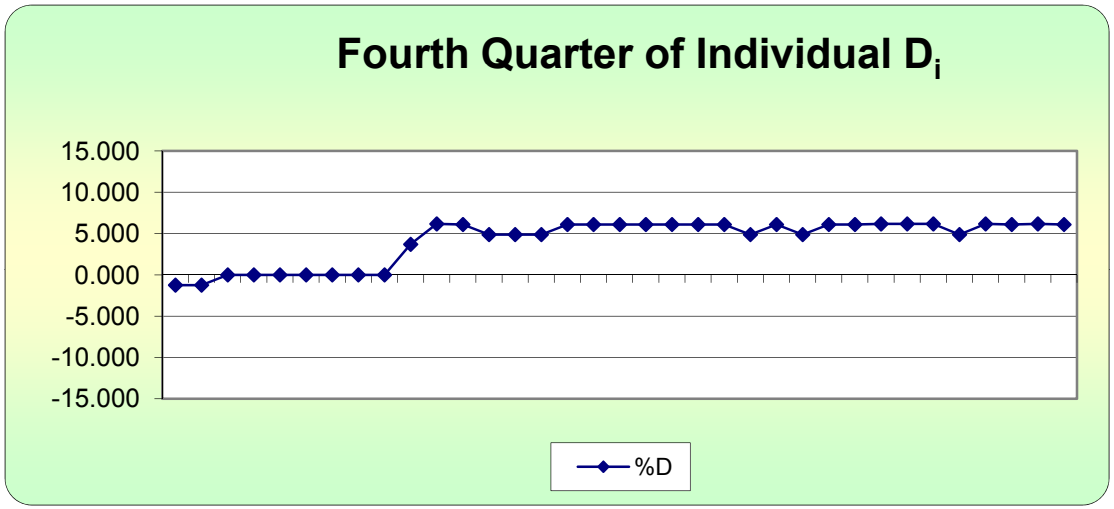
GAS QC check bias statistics (CFR App A, 4.1)

- All statistics start from the difference between your instrument's indicated value and the known (audit) value (meas-known)/known= $\mathbf{d_i}$
- **bias (jump)** is also calculated from $\mathbf{d_i}$
- Known bias uses the average of all the $\mathbf{d_i}$ values, and adds a factor based on t-statistic to get an upper bound for the bias
- Then, DASC looks at whether the bias is generally + or generally negative, based on the 25% and 75% percentiles—if both are + then you have a high bias

Bias:

- Bias is high
- Both percentiles are + so bias is +

25th Percentile
1.9
75th Percentile
6.1



Bias (%) (Eqn 3)
5.05
Signed Bias (%)
+5.05

GAS QC check bias(cont.):

- you can be ~ **95% sure that the absolute value of your bias is less than** this upper bound
- Guidance: each d_i should be <7% for O_3, 10% for other gasses
- The ***upper limit of your overall* bias** (based on many d_i) you calculate using DASC
- From DASC we see:

Signed Bias (%)
+5.05

- Corresponds to **Bias** in AMP255 (EPA calculates both for each site and for your whole PQAO network)

DATA QUALITY INDICATOR REPORT

1-Point Quality Control

O3 **PQAO:** 1136 (Washington State Department Of Ecology)

Region	State	Site ID	POC	MT	Begin Date	End Date	# Req	# Obs	% Complete	CV	Bias
10	WA	53-053-0012	1	S	01-OCT-11	31-DEC-11	6	35	100	3.27	+ 5.05

Summary of gas bias:

- Calculated from routine QC checks $\mathbf{d_i}$
- each check should be < 7% for O_3, 10% other gasses, then the:
- Overall upper limit of bias calculated from $\mathbf{d_i}$
- Then look at the sign (and the chart) for whether your analyzer is biased high (+) or low (-)

Part 3-PM flow rate (FR) check stats

What do you need to know about how you can use your monthly FR check results? What about the 6-mo FR checks? How can the DASC help you make sense of them?

Routine monthly FR checks:

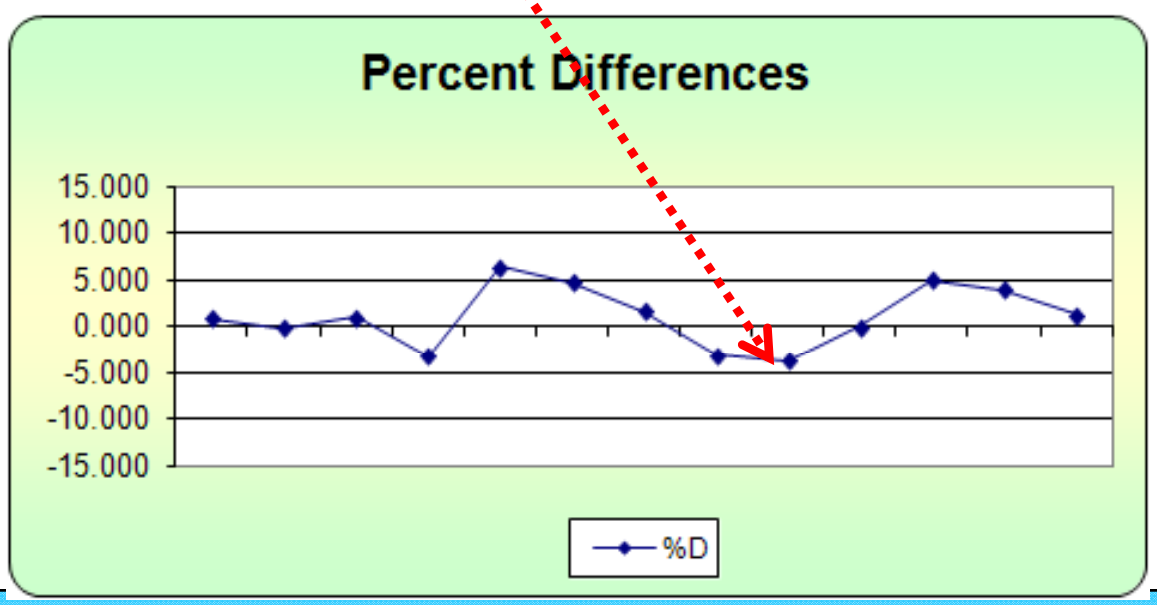
- Used by YOU to track your FR
- Used by EPA to estimate your bias and compare with your 6-mo FR audit results
- Uses same stats as gaseous, starting with $\mathbf{d_i}$
- (meas-known)/known= $\mathbf{d_i}$

Monthly FR verifications in DASC-what you can do:

Meas Val (Y)	Audit Val (X)	d (Eqn. 1)
16.67	16.52	0.908
16.67	16.71	-0.239
16.67	16.5	1.030
16.67	17.21	-3.138

YOU can use to track FR and assess potential trends

(You are not required to report these to AQS, but you can use DASC to track them)



6-mo FR audits-what EPA does:

Meas Val (Y)	Audit Val (X)	d (Eqn 1)
3	2.92	2.74
3	3.07	-2.28

"m" (Eqn 8) =mean

0.23

"S" (Eqn 9) =sample standard dev

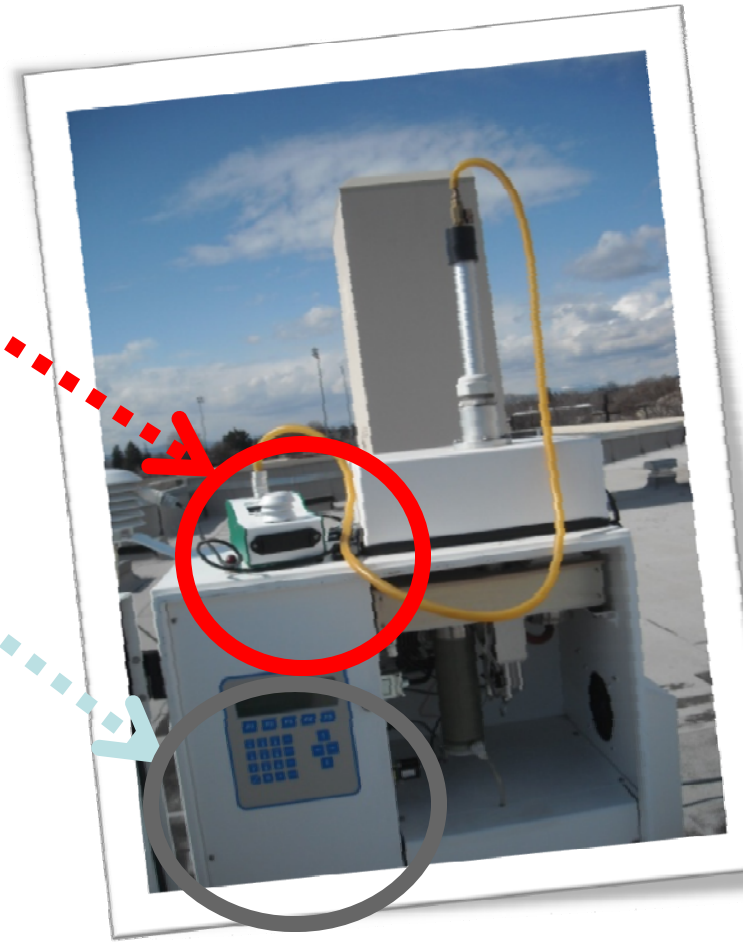
3.55 of the 6-month FR audits

95% Upper Probability Limit

7.2

95% Lower Probability Limit

-6.7



6-mo FR audits-what shows up in AMP255:

JALITY INDICATOR REPORT

Annual Flow Rate Audits

State Department Of Ecology)

This is just the mean of the 2 6-mo FR checks that DASC calculated for you

End Date	# Req	#Q w/ Data	% Complete	Criteria Met?	Obs / Q Q1	Q2	Q3	Q4	Avg %d	Flow Rate Conf. Limits Lower	Upper	% Between Conf. Limits
31-DEC-11	2	2	100	Y	1	0	1	0	0.2			
	33	36	97	88	11	6	10	9	0.1	-2.26	3.18	83
	33	36	97	88	11	6	10	9	0.1	-2.26	3.18	83

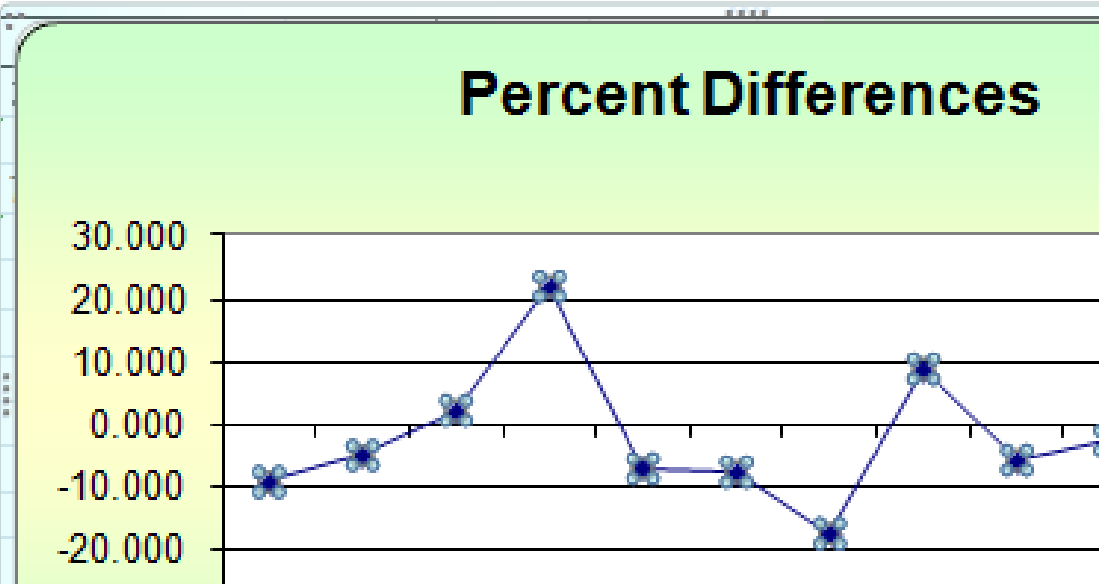
95% probability limits for your flow rate over whole PQAO

PM stats-collocated

- Use DASC for control chart

Precision Estimate (From Collocated Samples)

Meas Val (Y)	Audit Val (X)	d (Eqn 10)
5.05	5.55	-9.434
12.35	13	-5.128
14.67	14.35	2.205
9.59	7.68	22.119
10.51	11.3	-7.244
12.44	13.45	-7.802
3.78	4.51	-17.612
18.56	16.99	8.833
12.56	13.32	-5.873
7.68	7.89	-2.697



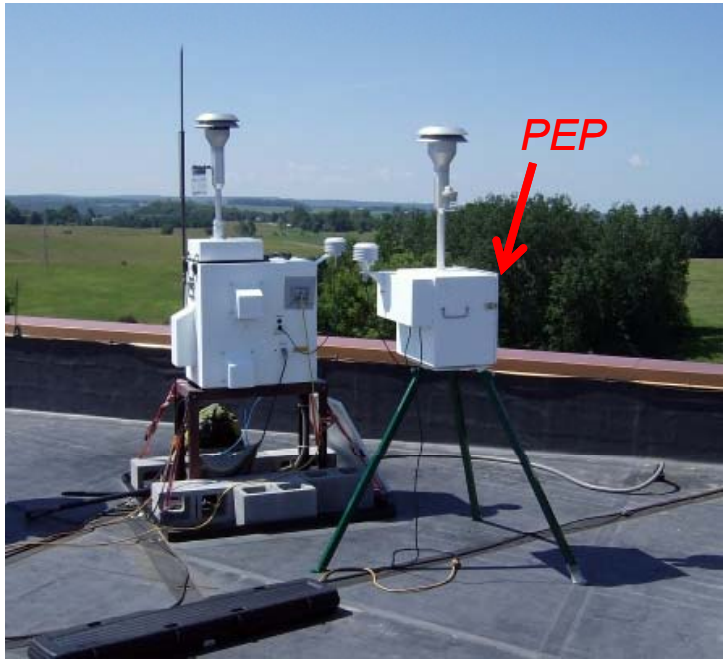
- And to check AMP 255

CV (%) (Eqn 11)
4.69

% Complete	CV
93	4.69

PM stats-PEP

- EPA uses to estimate BIAS (and when you get your PEP results you can use DASC to generate confidence intervals for your bias)



PM FR stats summary:

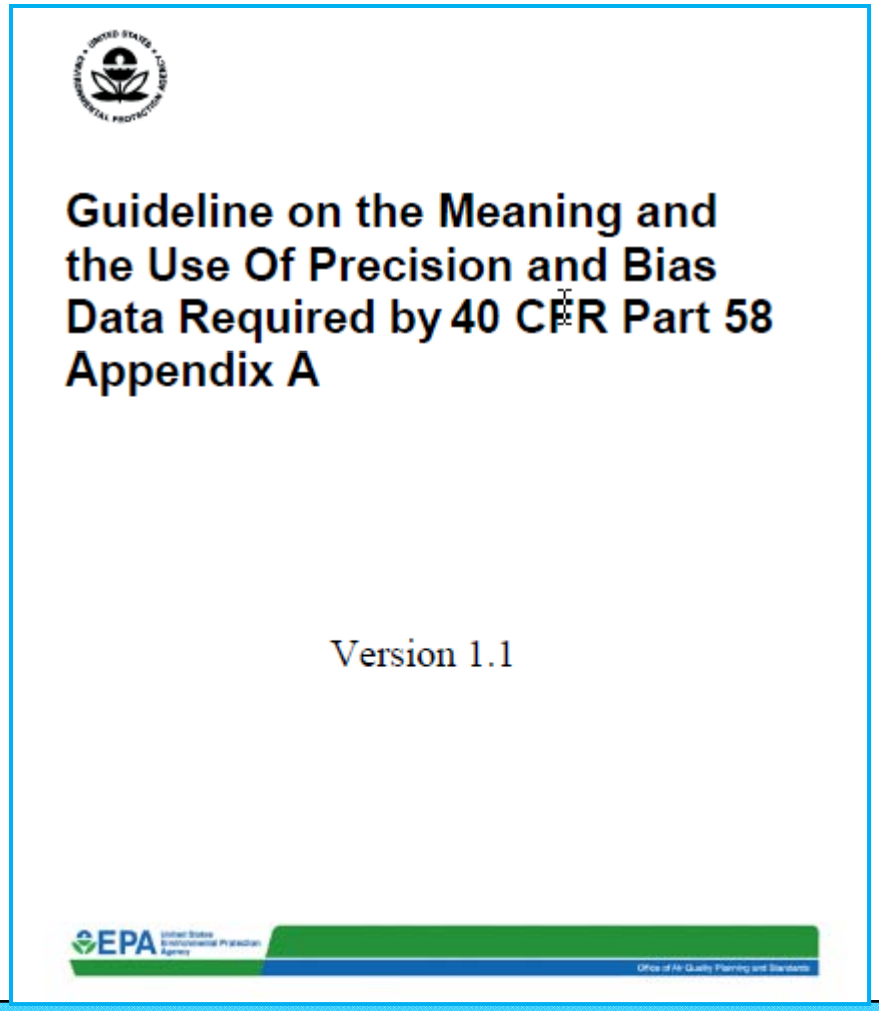
- Use d_i for monthly and 6-mo FR verifications
- Use DASC to plot monthly FR
- EPA uses 6-mo FR audits to generate limits on your FR over your entire PQAO; check these yourself in DASC
- PEP is used for independent national bias estimates
- Collocated data is used for precision estimates; you can calc in DASC also

CV (%) (Eqn 11)
4.69

← *90% upper bound of CV*

Now for even more information:

- Reporting requirements of App. A
- Box and whisker charts EPA prepares 4 u


Guideline on the Meaning and the Use Of Precision and Bias Data Required by 40 CFR Part 58 Appendix A

Version 1.1

EPA

Reporting in App. A:

5.1 Quarterly and Annual Reports

- ***Tables*** with DASC/AMP stats
- Bias, precision, completeness
- P.E. results
- Brief explanations (several sentenc
- Corrective action
- Lots of ***charts***
- Available online:
- **http://itep68.itep.nau.edu/itep_do loads/Appendix_A_Resources/**

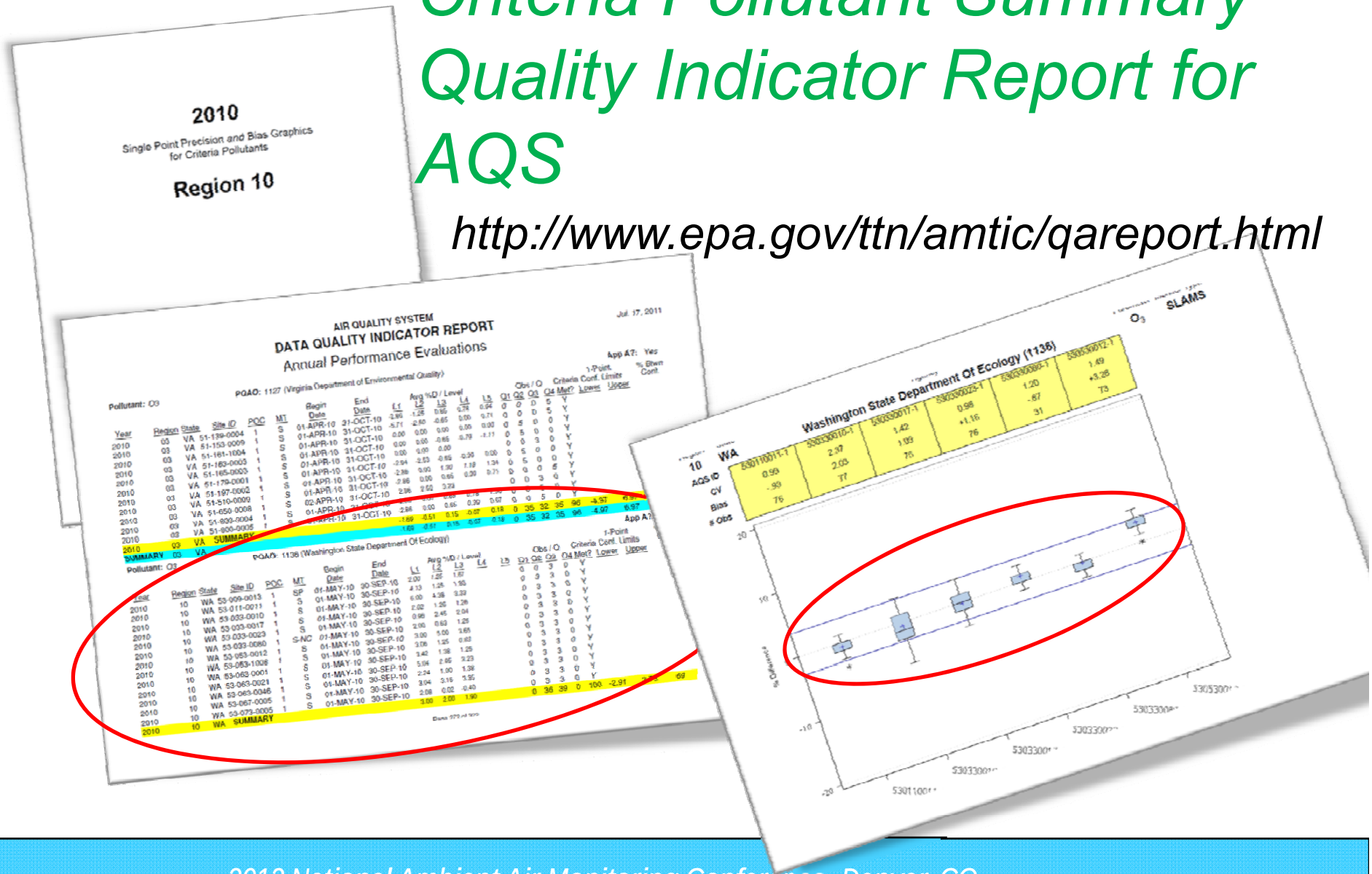
DEPARTMENT OF
ECOLOGY
State of Washington

Air Monitoring Data Quality Assessment Report
Fourth Quarter
2011

Prepared by Donovan Rafferty

Criteria Pollutant Summary Quality Indicator Report for AQS

http://www.epa.gov/ttn/amtic/qareport.html

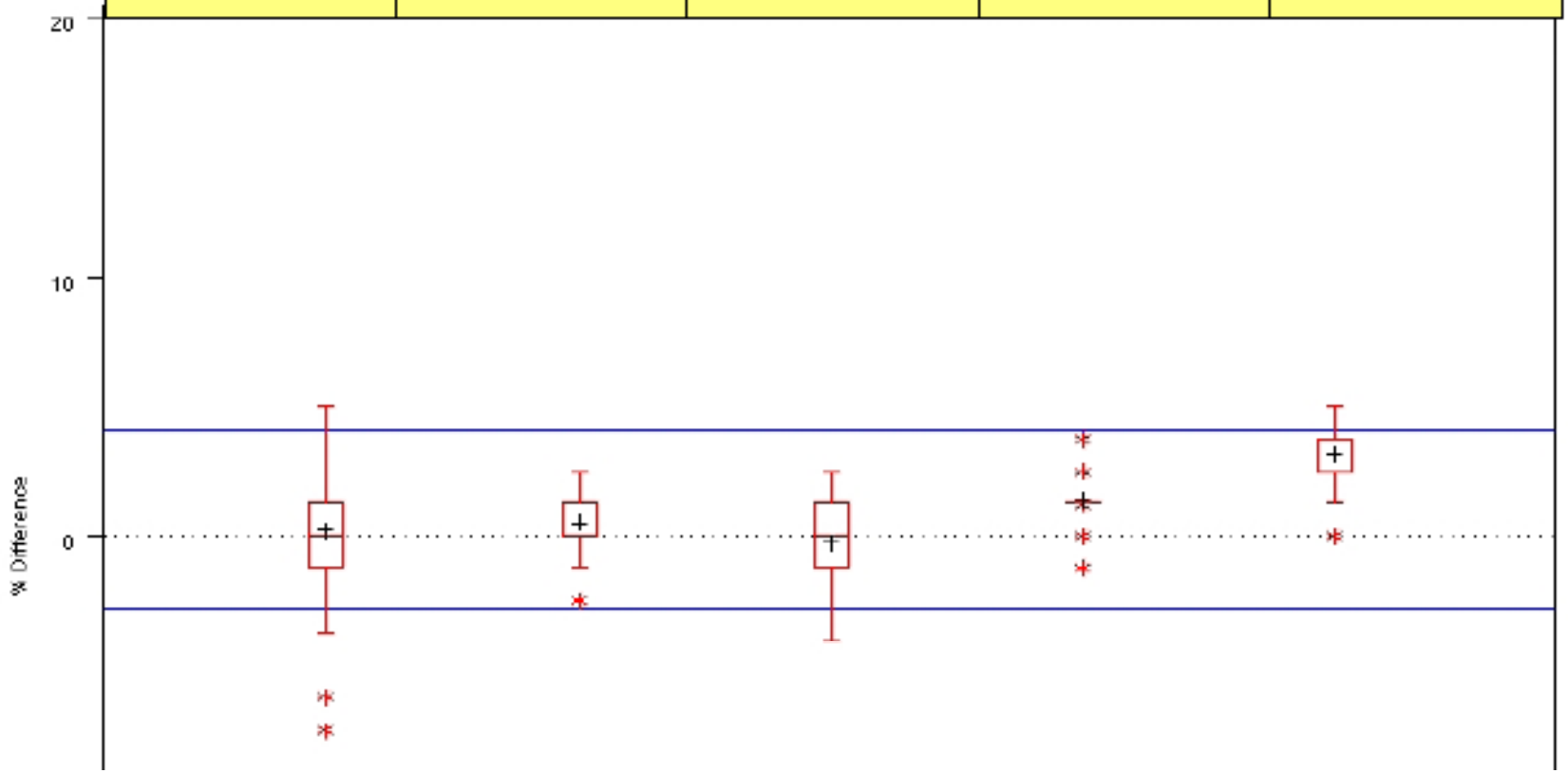


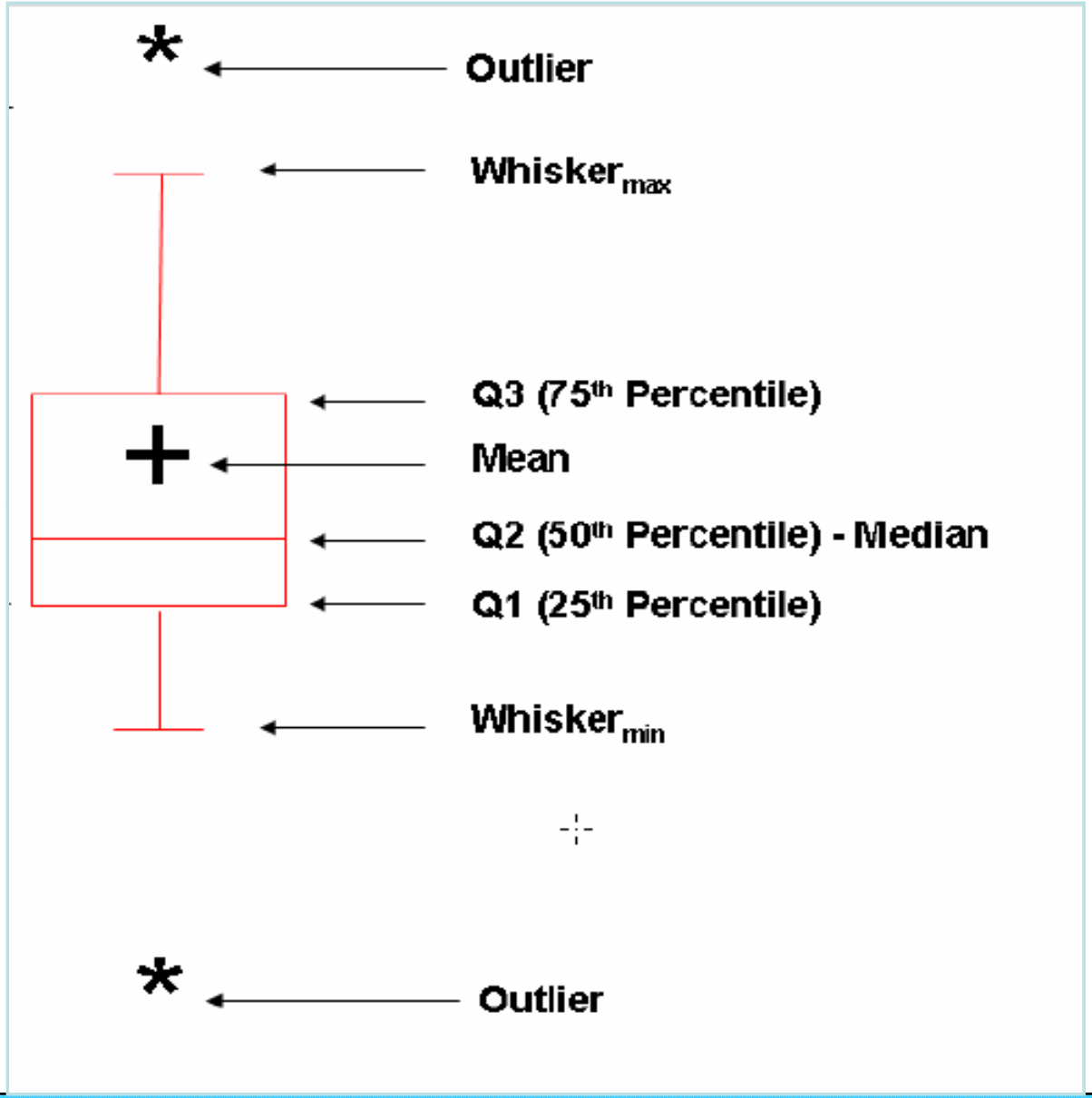
2012 National Ambient Air Monitoring Conference- Denver, CO

Appendix A in Half-a-Day

Region	State	Agency	Parameter
10	WA	Washington State Department Of Ecology (1136)	O_3

AQS ID	530110011-1	530330010-1	530330017-1	530330023-1	530330080-1
CV	2.08	1.21	1.64	0.98	1.23
Bias	1.60	+1.00	1.23	+1.52	+3.31
# Obs	153	153	144	151	152




Outlier
Whisker$_{max}$
Q3 (75th Percentile)
Mean
Q2 (50th Percentile) - Median
Q1 (25th Percentile)
Whisker$_{min}$
Outlier

Thanks!

- Donovan Rafferty draf461@ecy.wa.gov
- Melinda Ronca-Battista melinda.ronca-battista@nau.edu
- Our materials at **http://itep68.itep.nau.edu/itep_downloads/Appendix_A_Resources/**

Blue Collar Quality Assurance

Reminders for field grunts and data reviewers

Greg Noah
EPA Region 4, Science and Ecosystem Support Division

2012 National Ambient Air Monitoring Conference- Denver, CO

Appendix A in Half-a-Day

Blue Collar Quality Assurance Elements

Lets get down in the dirt to remind ourselves what should be happening in the field why we do quality assurance...

Recordkeeping

Data Review

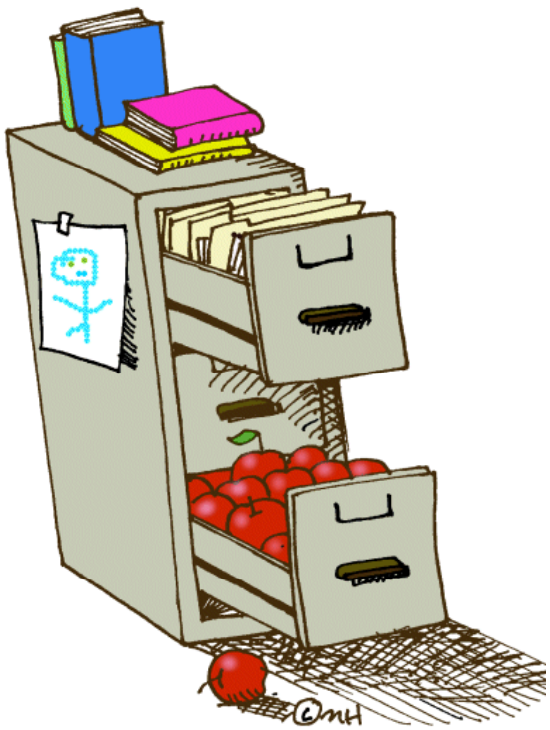
Calibrations

Using QC Data

Monitoring Site Siting and Probes

Routine stuff for field grunts. These ain't "Ivory Tower" assessments, no offense, Mike!!

Recordkeeping



- *Are there records and where are they?*
  - *What should you record?*
- *Can you recreate your data?*
  - *Missing data reports, flags, P&A checks, raw data*
- *Do you have detail?*
  - *Please no "Sampler Malfunction"s*
- *Is it organized?*
- *Is it backed up?*
- *Does everyone know where stuff is located?*

Remember... If you don't document it, you DIDN'T do it!!!

Data Review

Key Data Review Components

- *Flow chart of review process*
- *Specific responsibilities assigned to staff*
- *Evidence of review, signatures, notes, reports*
- *Availability of electronic data*
- *Organization of data*

Data Review

Data Flagging

- Many data flags begin in the field
- Record any unusual event
  - Nearby fires
  - Road paving
  - Shelter conditions out of tolerance
- Note data anomalies
  - P&A or calibration times
  - Unusual patterns
  - Strange spikes
  - Questionable monitor performance

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Sep. 9, 2006

(44201) Ozone

SITE ID: 12-099-0009 POC: 1
COUNTY: (099) Palm Beach
CITY: (62100) Royal Palm Beach
SITE ADDRESS: 980 CRESTWOOD BLVD NORTH
SITE COMMENTS:
MONITOR COMMENTS: MFR. MONITOR LABS MODEL 9812 CONTINUOUS OZONE MONITOR

STATE: (12) Florida
AQCR: (050) SOUTHEAST FLORIDA
URBANIZED AREA: (8960) WEST PALM BEACH-BOCA RATON-DELRAY
LAND USE: RESIDENTIAL
LOCATION SETTING: SUBURBAN

CAS NUMBER: 10028-15-6
LATITUDE: 26.731
LONGITUDE: -80.234
UTM ZONE: 17
UTM NORTHING: 2956704.65
UTM EASTING: 576181.6
ELEVATION-MSL: 0
PROBE HEIGHT: 3

SUPPORT AGENCY: (0833) Palm Beach County Health Department
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (047) INSTRUMENTAL ULTRA VIOLET
REPORTING ORG: (0833) Palm Beach County Health Department

REPORT FOR: NOVEMBER 2005

DURATION: 1 HOUR
UNITS: Parts per million
MIN DETECTABLE: .005

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	0	
2	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	0	
3	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AT	AT	.043	.043	.042	.040	.041	.037	.034	.031	.031	.030	.026	.027	12	.043
4	.027	.026	.025	.021	.021	.016	.012	.010	.016	.030	.038	.039	.038	.038	.037	.036	.034	.033	.026	.025	.031	.033	.032	.032	24	.039
5	.035	.036	.036	.036	.035	.034	.031	.026	.036	.039	[illegible]	.039	.039	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.019	.016	.010	24	.040
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.017	.023	[illegible]	.029	.030	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.025	.025	.021	24	.030
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.010	.021	[illegible]	.025	.023	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.012	.009	.008	24	.027
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.017	.027	[illegible]	.030	.029	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.021	.017	.010	24	.032
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.014	.035	[illegible]	.044	.045	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.015	.014	.010	24	.045
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.028	.036	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.013	.009	.010	24	.064
11	.007	.002	.017	.016	.017	.013	.008	.013	.020	.031	.041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.041	.030	.024	24	.049
12	.023	.035	.037	.029	.020	.024	.020	.018	.031	.040	.042	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.039	.039	.039	24	.043
13	.039	.038	.038	.038	.037	.035	.035	.036	.039	.041	.041	.041	.040	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.037	.036	.036	24	.041
14	.037	.036	.035	.030	.021	.028	.026	.020	.022	.034	.037	.036	.036	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.033	.033	.033	24	.037
15	.034	.033	.032	.032	.030	.026	.017	.019	.030	.034	.036	.038	.038	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.026	.021	.028	24	.041
16	.029	.020	.031	.030	.032	.026	.018	.016	.017	.032	.036	.037	.037	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.002	.002	.002	24	.037
17	.002	.002	.008	.011	.009	.010	.010	.012	.020	.026	.030	AT	AT	.035	.038	.038	.037	.036	.034	.032	.030	.031	.029	.029	22	.038
18	.029	.027	.027	.022	.019	.017	.014	.019	.025	.032	.035	.033	.037	.035	.031	.030	.026	.028	.028	.029	.025	.027	.028	.030	24	.037
19	.030	.030	.030	.030	.030	.028	.027	.026	.024	.028	.030	.031	.032	.031	.031	.030	.031	.025	.027	.024	.027	.029	.031	.027	24	.032
20	.024	.024	.027	.024	.024	.022	.024	.023	.021	.024	.024	.029	.032	.033	.032	.033	.028	.027	.025	.024	.022	.022	.020	.017	24	.033
21	.014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.011	.007	.015	.022	.026	.028	.032	.030	.027	.025	.026	.025	.030	.036	.038	.040	.043	.042	24	.043
22	.040	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.037	.040	.041	.043	.045	.045	.042	.039	.035	.034	.031	.026	.025	.021	24	.045
23	.021	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AN	AN	AN	.037	.041	.043	.043	.035	.024	.017	.006	.009	.016	.013	20	.043
24	.013	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.041	.049	.051	.052	.051	.050	.047	.044	.039	.037	.036	.039	.039	.037	24	.052
25	.034	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.027	.018	.029	.038	.044	.050	.052	.054	.054	.055	.057	.054	.039	.023	.014	.011	.005	.006	24	.057
26	.002	.009	.012	.009	.010	.010	.016	.012	.023	.042	.055	.054	.055	.053	.052	.051	.048	.041	.032	.021	.019	.039	.044	.044	24	.055
27	.042	.039	.036	.029	.025	.030	.023	.025	.034	.035	.035	.036	.036	.037	.036	.035	.034	.033	.028	.025	.031	.030	.030	.028	24	.042
28	.027	.028	.031	.030	.030	.029	.019	.015	.022	.029	.030	.031	.031	.031	.030	.029	.026	.025	.026	.027	.030	.030	.028	.028	24	.031
29	.028	.027	.027	.028	.028	.028	.024	.021	.025	.028	.029	.024	.027	.025	.021	.020	.012	.015	.021	.020	.014	.010	.010	.009	24	.029
30	.006	.002	.002	.002	.002	.002	.002	.002	.013	.017	.018	.022	.025	.023	.022	.023	.014	.017	.023	.025	.029	.033	.031	.022	24	.033
31																									0	
NO.:	27	27	27	27	27	27	27	27	27	26	26	25	26	28	28	28	28	28	28	28	28	28	28	28		
MAX:	.042	.039	.040	.041	.039	.038	.037	.036	.039	.042	.055	.054	.055	.062	.064	.064	.060	.054	.043	.039	.039	.041	.044	.044		
AVG:	.0221	.0215	.0237	.0222	.0207	.0201	.0177	.0170	.0237	.0314	.0347	.0368	.0382	.0381	.0375	.0370	.0350	.0327	.0290	.0261	.0255	.0258	.0246	.0230		

What happened?

Calibration after service recorded, good!

Records?

MONTHLY OBSERVATIONS: 654 MONTHLY MEAN: .0277 MONTHLY MAX: .064

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the region has

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT

Sep. 9, 2006

(44201) Ozone

SITE ID: 12-099-0009 POC: 1
COUNTY: (099) Palm Beach
CITY: (62100) Royal Palm Beach
SITE ADDRESS: 980 CRESTWOOD BLVD NORTH
SITE COMMENTS:
MONITOR COMMENTS: MFR. MONITOR LABS MODEL 9812 CONTINUOUS OZONE MONITOR

STATE: (12) Florida
AQCR: (050) SOUTHEAST FLORIDA
URBANIZED AREA: (8960) WEST PALM BEACH-BOCA RATON-DELRAY
LAND USE: RESIDENTIAL
LOCATION SETTING: SUBURBAN

CAS NUMBER: 10028-15-6
LATITUDE: 26.731
LONGITUDE: -80.234
UTM ZONE: 17
UTM NORTHING: 2956704.65
UTM EASTING: 576181.6
ELEVATION-MSL: 0
PROBE HEIGHT: 3

SUPPORT AGENCY: (0833) Palm Beach County Health Department
MONITOR TYPE: SLAMS
COLLECTION AND ANALYSIS METHOD: (047) INSTRUMENTAL ULTRA VIOLET
REPORTING ORG: (0833) Palm Beach County Health Department

REPORT FOR: NOVEMBER 2005

DURATION: 1 HOUR
UNITS: Parts per million
MIN DETECTABLE: .005

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MAXIMUM
1	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	0	
2	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	0	
3	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AT	AT	.043	.043	.042	.040	.041	.037	.034	.031	.031	.030	.026	.027	12	.043
4	.027	.026	.025	.021	.021	.016	.012	.010	.016	.030	.038	.039	.038	.038	.037	.036	.034	.033	.026	.025	.031	.033	.032	.032	24	.039
5	.035	.036	.036	.036	.035	.034	.031	.026	.036	.039	.040	.039	.039	.040	.039	.037	.036	.034	.029	.021	.023	.019	.016	.010	24	.040
6	.007	.006	.012	.013	.006	.002	.002	.008	.017	.023	.025	.029	.030	.030	.028	.026	.027	.028	.026	.025	.025	.025	.025	.021	24	.030
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.010	.021	.023	.025	.023	.024	.025	.027	.025	.024	.020	.021	.021	.012	.009	.008	24	.027
8									.017	.027	.029	.030	.029	.030	.032	.030	.029	.027	.023	.023	.024	.021	.017	.010	24	.032
9									.014	.035	.041	.044	.045	.044	.043	.040	.039	.038	.033	.023	.018	.015	.014	.010	24	.045
10									.028	.036	.039	.046	.054	.062	.064	.064	.060	.053	.043	.023	.018	.013	.009	.010	24	.064
11									.020	.031	.041	.047	.048	.049	.049	.049	.048	.044	.039	.034	.039	.041	.030	.024	24	.049
12									.031	.040	.042	.043	.043	.040	.038	.039	.039	.038	.038	.039	.039	.039	.039	.039	24	.043
13									.039	.041	.041	.041	.040	.040	.041	.041	.038	.032	.031	.031	.030	.037	.036	.036	24	.041
14									.022	.034	.037	.036	.036	.033	.032	.031	.030	.029	.025	.033	.035	.033	.033	.033	24	.037
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.030	.034	.036	.038	.038	.041	.039	.038	.034	.030	.026	.020	.023	.026	.021	.028	24	.041
16	.029	.020	.031	.030	.032	.026	.018	.016	.017	.032	.036	.037	.037	.034	.029	.032	.030	.025	.009	.007	.006	.002	.002	.002	24	.037
17	.002	.002	.008	.011	.009	.010	.010	.012	.020	.026	.030	AT	AT	.035	.038	.038	.037	.036	.034	.032	.030	.031	.029	.029	22	.038
18	.029	.027	.027	.022	.019	.017	.014	.019	.025	.032	.035	.033	.037	.035	.031	.030	.026	.028	.028	.029	.025	.027	.028	.030	24	.037
19	.030	.030	.030	.030	.030	.028	.027	.026	.024	.028	.030	.031	.032	.031	.031	.030	.031	.025	.027	.024	.027	.029	.031	.027	24	.032
20	.024	.024	.027	.024	.024	.022	.024	.023	.021	.024	.024	.029	.032	.033	.032	.033	.028	.027	.025	.024	.022	.022	.020	.017	24	.033
21	.014	.016	.017	.016	.016	.016	.011	.007	.015	.022	.026	.028	.032	.030	.027	.025	.026	.025	.030	.036	.038	.040	.043	.042	24	.043
22	.040	.038	.040	.041	.039	.038	.037	.033	.033	.035	.037	.040	.041	.043	.045	.045	.042	.039	.035	.034	.031	.026	.025	.021	24	.045
23	.021	.020	.028	.031	.030	.026	.024	.023	.025	AN	AN	AN	AN	.037	.041	.043	.043	.035	.024	.017	.006	.009	.016	.013	20	.043
24	.013	.016	.023	.019	.014	.015	.012	.017	.033	.038	.041	.049	.051	.052	.051	.050	.047	.044	.039	.037	.036	.039	.039	.037	24	.052
25	.034	.032	.030	.029	.029	.029	.027	.018	.029	.038	.044	.050	.052	.054	.054	.055	.057	.054	.039	.023	.014	.011	.005	.006	24	.057
26	.002	.009	.012	.009	.010	.010	.016	.012	.023	.042	.055	.054	.055	.053	.052	.051	.048	.041	.032	.021	.019	.039	.044	.044	24	.055
27	.042	.039	.036	.029	.025	.030	.023	.025	.034	.035	.035	.036	.036	.037	.036	.035	.034	.033	.028	.025	.031	.030	.030	.028	24	.042
28	.027	.028	.031	.030	.030	.029	.019	.015	.022	.029	.030	.031	.031	.031	.030	.029	.026	.025	.026	.027	.030	.030	.028	.028	24	.031
29	.028	.027	.027	.028	.028	.028	.024	.021	.025	.028	.029	.024	.027	.025	.021	.020	.012	.015	.021	.020	.014	.010	.010	.009	24	[illegible]
30	.006	.002	.002	.002	.002	.002	.002	.002	.013	.017	.018	.022	.025	.023	.022	.023	.014	.017	.023	.025	.029	.033	.031	.022	24	
31																									0	
NO.:	27	27	27	27	27	27	27	27	27	26	26	25	26	28	28	28	28	28	28	28	28	28	28	28		
MAX:	.042	.039	.040	.041	.039	.038	.037	.036	.039	.042	.055	.054	.055	.062	.064	.064	.060	.054	.043	.039	.039	.041	.044	.044		
AVG:	.0221	.0215	.0237	.0222	.0207	.0201	.0177	.0170	.0237	.0314	.0347	.036[illegible]	.0382	.0381	.0375	.0370	.0350	.0327	.0290	.0261	.0255	.0258	.0246	.0230		

MONTHLY OBSERVATIONS: 654 MONTHLY MEAN: .0277 MONTHLY MAX: .0[illegible]

Note: Qualifier codes with regional concurrence are shown in upper case, and those without regional review are shown in lower case. An asterisk ("*") indicates that the regio[illegible]

Data reviewed? Need flags?

Outliers or exceedences?

Signed and dated somewhere?

Calibrations

Needed when verifications show measurements out of limits, or when required by QAPP

Verification = Done without making adjustments to instrument response and prove system is operating within MQOs; therefore, DQOs should be met

Calibration = Instrument response is changed, and are made when No Adjustment

We calibrate:

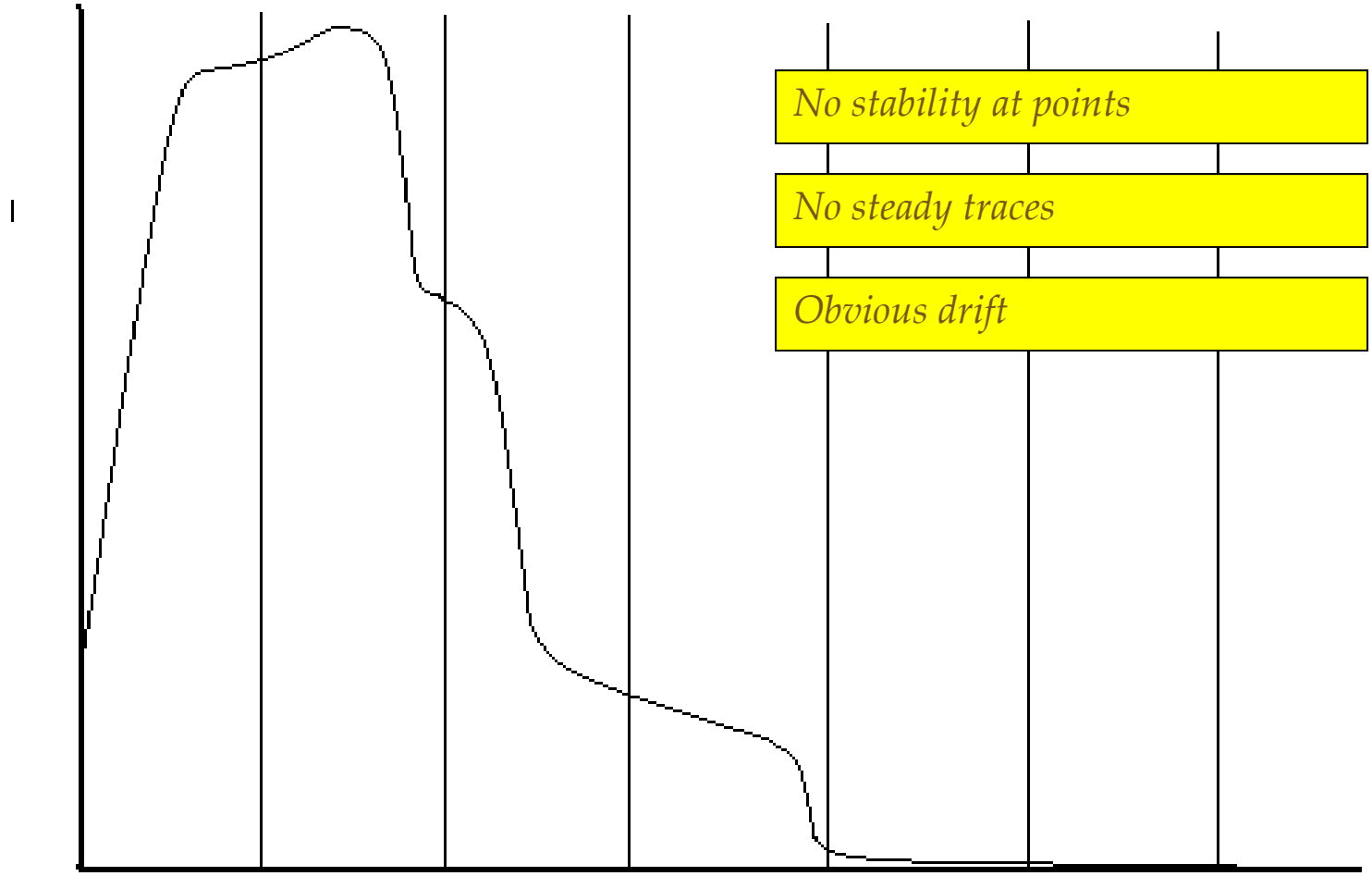
- *Monitors/Samplers*
- *Calibrators*
- *Data loggers*
- *Voltage outputs*

Calibrations: Common Issues

Garbage in, garbage out…

- *If you calibrate flow on a sampler and "tell it" 16.67 LPM is 15 LPM, the sampler will read 16.67 LPM on the display. Samplers will lie to you.*

- *If you don't let a check point stabilize, your calibration may be biased! This applies to continuous analyzers and filter based samplers*

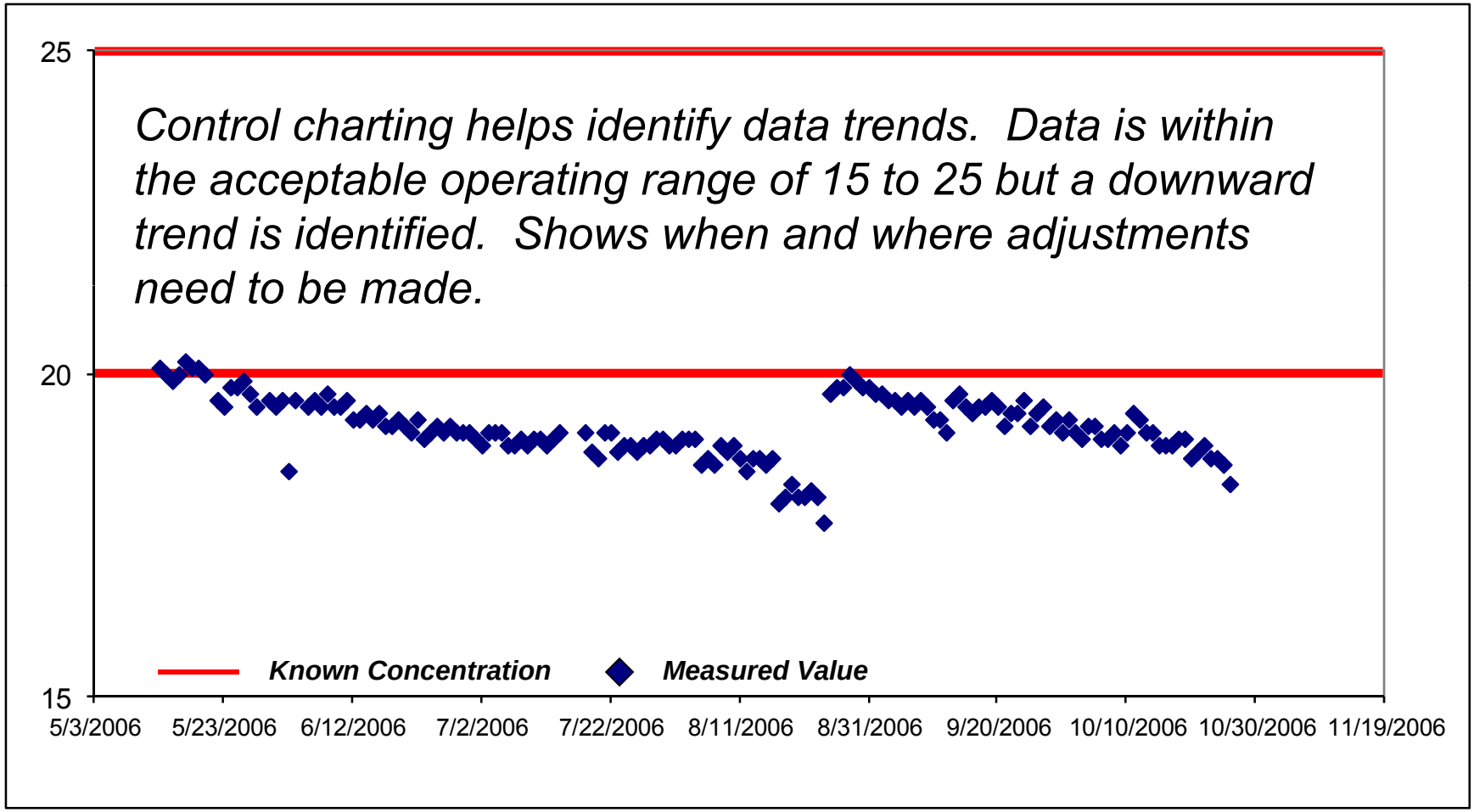


Poor Calibration

Good Calibration

Using QC Data – An Example

One-Point QC Check



More Control Charts

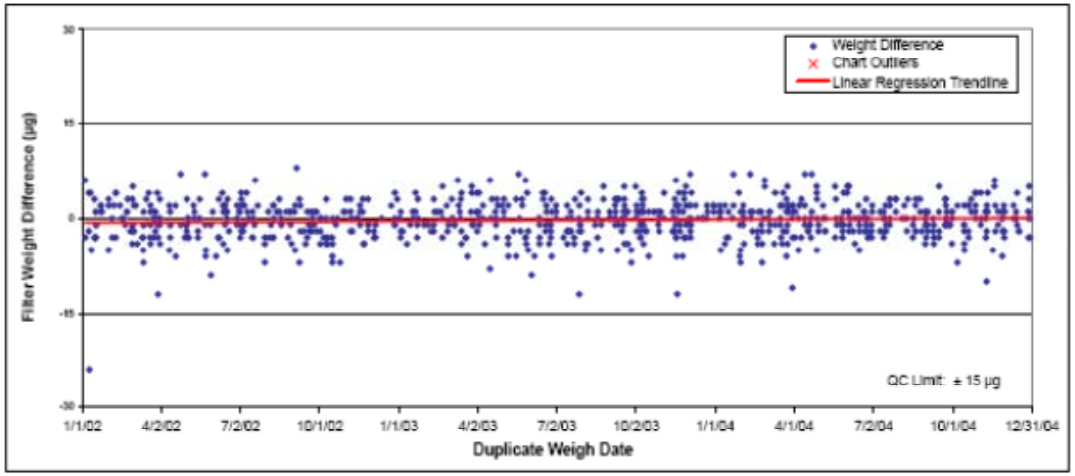
Control Charts can show:

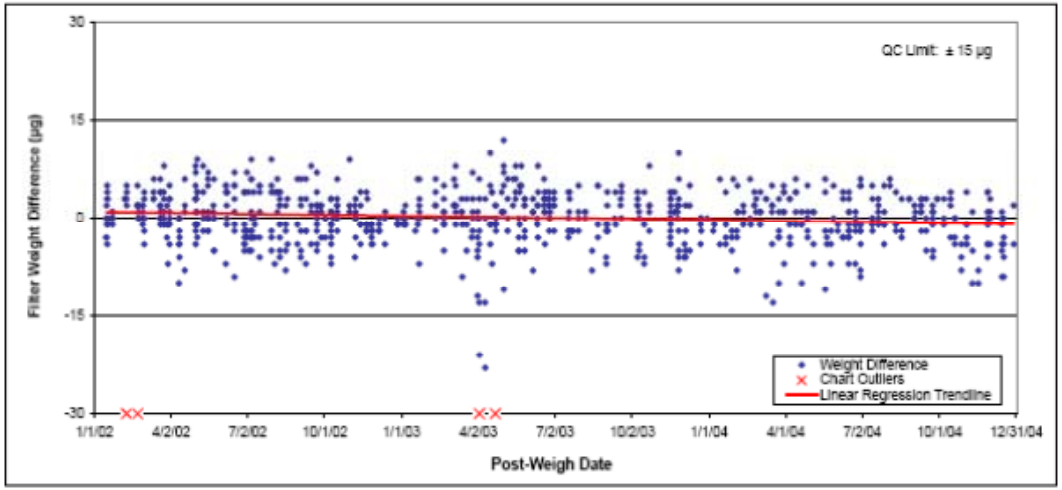
You are meeting your MQOs

Show you trends

Identify problem areas

Monitor completeness





Siting Requirements

Different Monitors Have Different

Siting Criteria

A few common questions to consider...

- *Does the site represent the scale I want to monitor?*
- *Does it have 270 degrees unobstructed air flow or 180 degrees if on the side of a building?*
- *Does anything obstruct air flow, i.e. trees, buildings, backstops?*
- *How far away from trees is my site?*
- *Are there any sources nearby that may impact your sampler or analyzer?*
- *How far am I from roads? What is the traffic count?*
- *How high is my probe?*

All specific regulations for siting all pollutant monitors can be found in

40 CFR, Part 58, Appendix E

Siting Requirements

Example: Probes located too close to trees

Shout out to everyone...

Review your sites annually! Conditions around the site are always changing.

Site Maintenance and Design

Is your site well maintained?

- *Clean*
- *Proper residence time*
- *Organized*
- *Useable area*
- *Good temperature control*
- *Safety*

Sample Lines/Probes

Are your sample probes well maintained?

- *Are they clean?*
- *Documented cleaning or replacement?*
- *Observe inside AND outside of the shelter?*
- *Constructed of teflon, glass or stainless steel?*

What have we found in Sample Lines/Systems?

- *Spider webs*
- *Water*
- *Dirt*
- *Nylon*
- *Tygon*
- *PVC*
- *Electrical tape*
- *Dead birds (yes, really)*

Parting Words...

There are many more Quality Assurance tools and checks to assess your networks precision, accuracy, and bias. The ones covered are only a few...

Many references are available for specific monitoring objectives. See AMTIC and the Redbook

You can collect QA data all day long, but if you don't use it, the most likely result will be poor biased data that is indefensible.

Don’t be “that guy”

(Its not ok even though the sampler is upwind)

Greg Noah
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