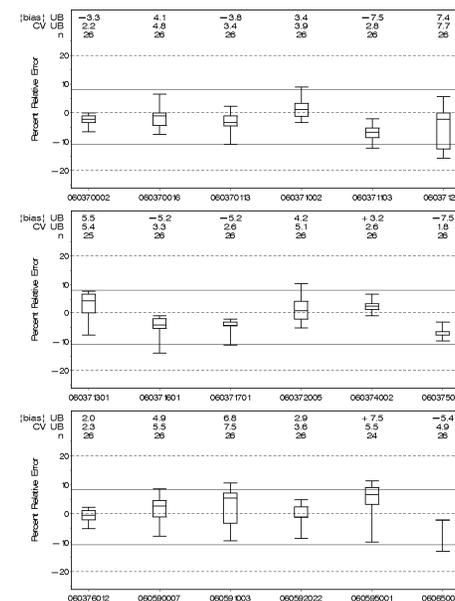


Appendix A in Half-A-Day

A walk through of 40 CFR Part 58 Appendix A



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day



Training Goal

- Provide the big picture
 - From A Requirements standpoint
- Don't expect details
 - See Handbook guidance
- 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?



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Prelude for Newcomers

- The words we use.....



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day



CAA- Clean Air Act

“(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?



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Quality Assurance

Some decisions will be inappropriate (wrong) due to

E4- Part of quality management focused on providing confidence that **data uncertainty** will be fulfilled.

Another Definition - **the difference between your measurement (estimate) and the "truth"** A system of activities whose purpose is to ensure that information derived from measurements are of a quality that the decision maker is willing to **risk making an inappropriate 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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day

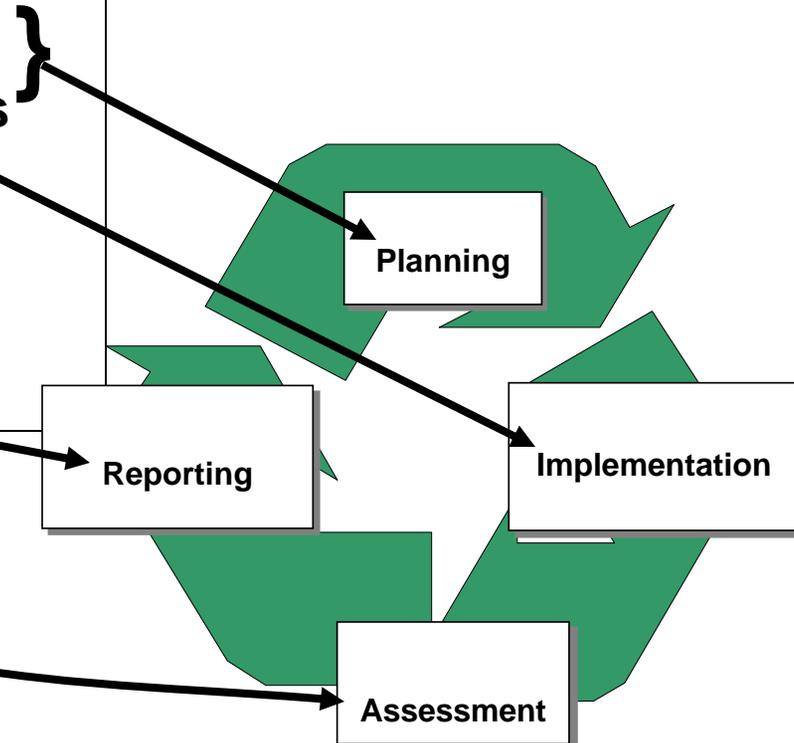


40 CFR Part 58 Appendix A

Provides a minimum set of requirements on which to plan, implement, assess and report on data quality

Sections

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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Section 1

General Information

Provides the setting / context of Appendix A

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

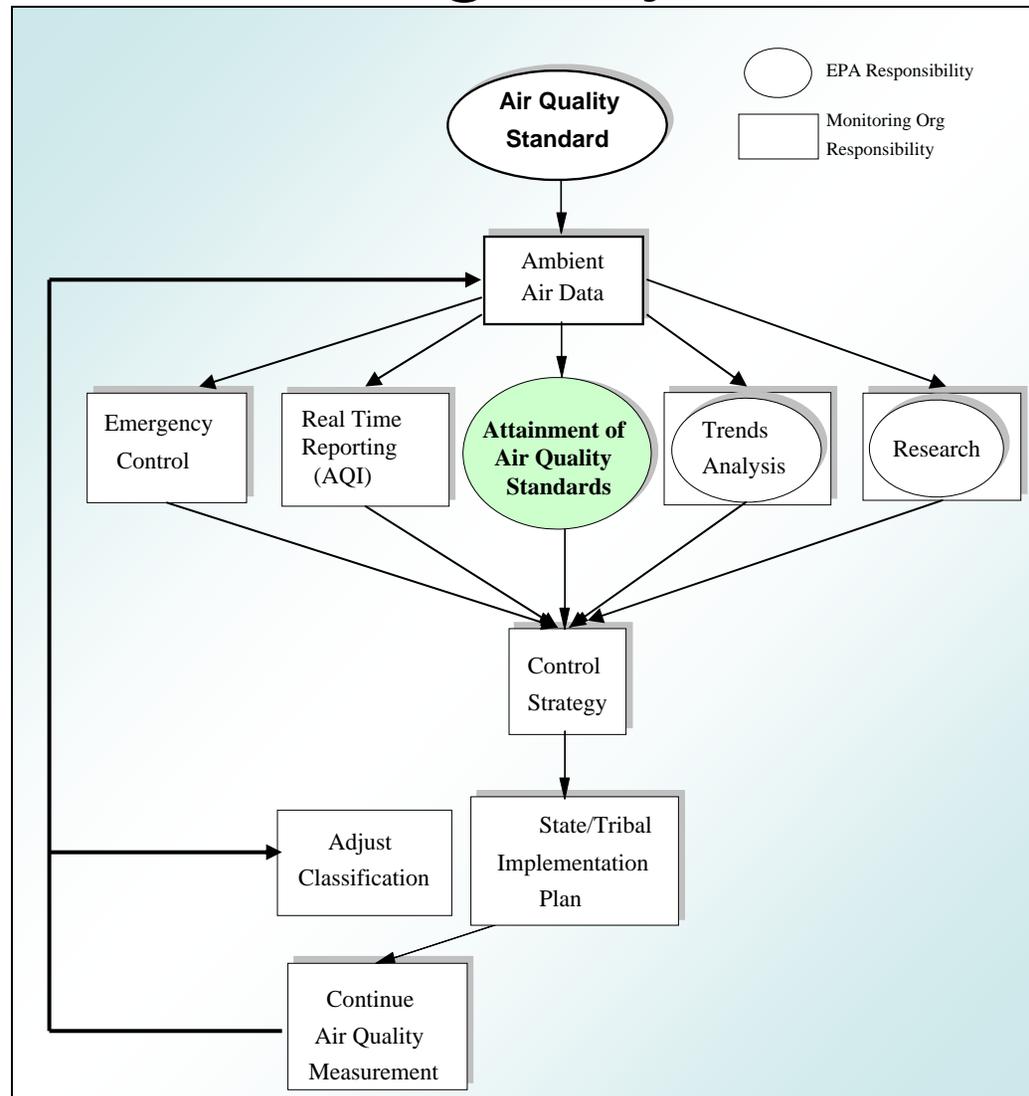


2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Monitoring Objectives



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day



Section 1 - Applicability

- Generally for comparison to NAAQS
 - SLAMS (NCore a subset),
 - SPM
 - Using FEM/FRM/ARM and meeting App E siting criteria.
 - Tribal Monitors used for NAAQS
- PSD monitoring prior to construction to determine industry or municipal source impact on ambient concentrations
- Merged Appendix B with A in 2006
 - Most requirements the same but **there are differences**. Differences spelled out in text and in Table A-1

Monitors **without** the **“non-regulatory”** monitor type designation in AQS will be deemed as following Appendix A.

This is for assessment purposes only, but if a monitor is not planned for use in NAAQS decisions, use of the non-regulatory monitor type is suggested!

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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Section 1 - Applicability

- What are the Pollutant Monitoring Networks Covered by Appendix A?

*O₃, SO₂, NO_{x,y}, CO,
PM₁₀, PM_{2.5}, PM_{10-2.5}, Lead (Pb)*

- What Other Networks have QA Programs?

Toxics

- What Other QA Programs are Likely to Evolve?

PAMS



*2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day*



In 2006 EPA Removed Appendix B (PSD Requirements) and merged it with Appendix A.

**Table A-1
Differences and Similarities
between
SLAMS and PSD Requirements**

Topic	SLAMS	PSD
Requirements	1. The development, documentation, and implementation of an approved quality system. 2. The assessment of data quality. 3. The use of reference, equivalent, or approved methods. 4. The use of calibration standards traceable to NIST or other primary standard. 5. The participation in EPA performance evaluations and the permission for EPA to conduct system audits.	
Monitoring and QA Responsibility	State/local agency via the "primary quality assurance organization"	Source owner/operator.
Monitoring Duration	Indefinitely	Usually up to 12 months.
Annual Performance Evaluation (PE)	Standards and equipment different from those used for spanning, calibration, and verifications. Prefer different personnel.	Personnel, standards and equipment different from those used for spanning, calibration, and verifications.
PE audit rate		
-Automated	100% per year.	100% per quarter.
-Manual	Varies depending on pollutant. See Table A-2 of this appendix.	100% per quarter.
Precision Assessment		
-Automated	One-point QC check biweekly but data quality dependent.	One point QC check biweekly.
-Manual	Varies depending on pollutant. See Table A-2 of this appendix.	One site: 1 every 6 days or every third day for daily monitoring (TSP and Pb).
Reporting		

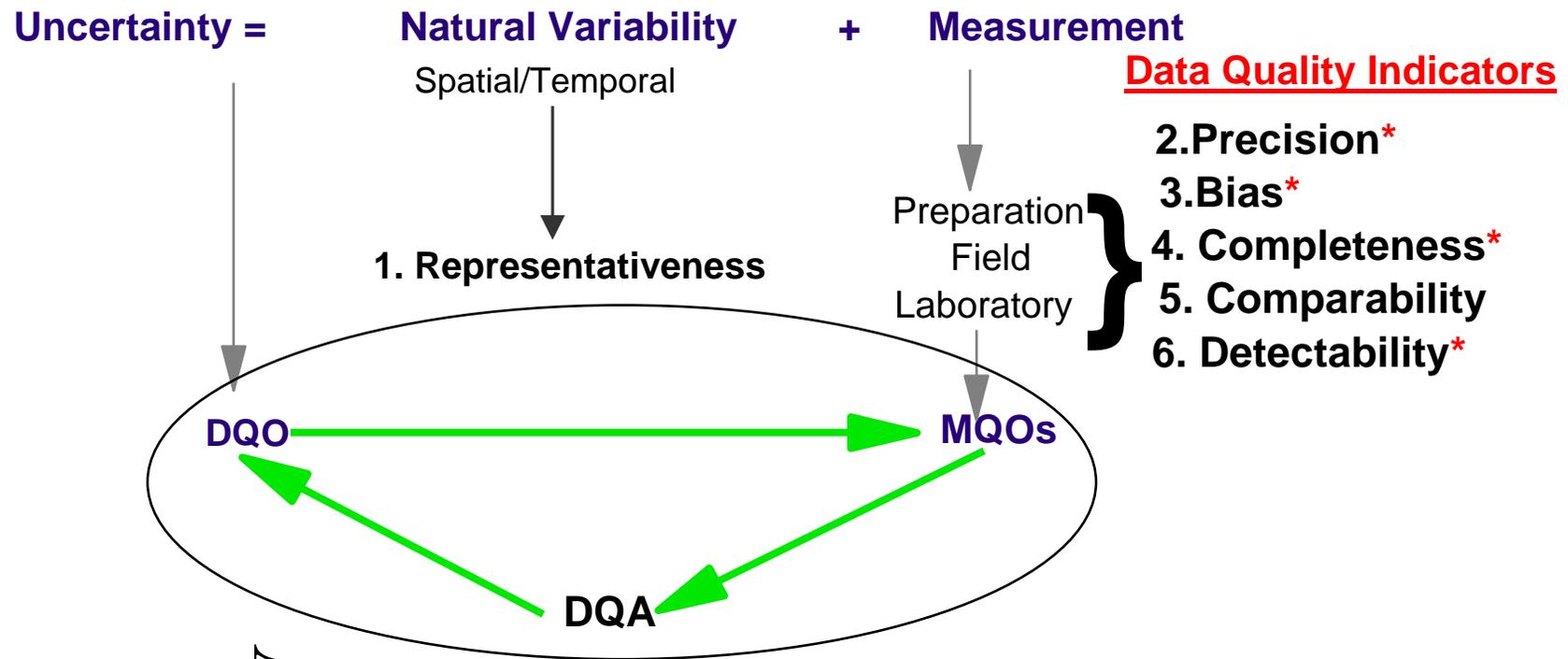


*2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day*



Section 1.2 - Measurement Uncertainty

Understanding and Controlling **Uncertainty**
in Order to Minimize **Decision Errors**



The Quality System



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Section 1.2 -Measurement Uncertainty

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

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.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



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.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Section 1.4 –Assessments and Reports

Key feature in the quality system

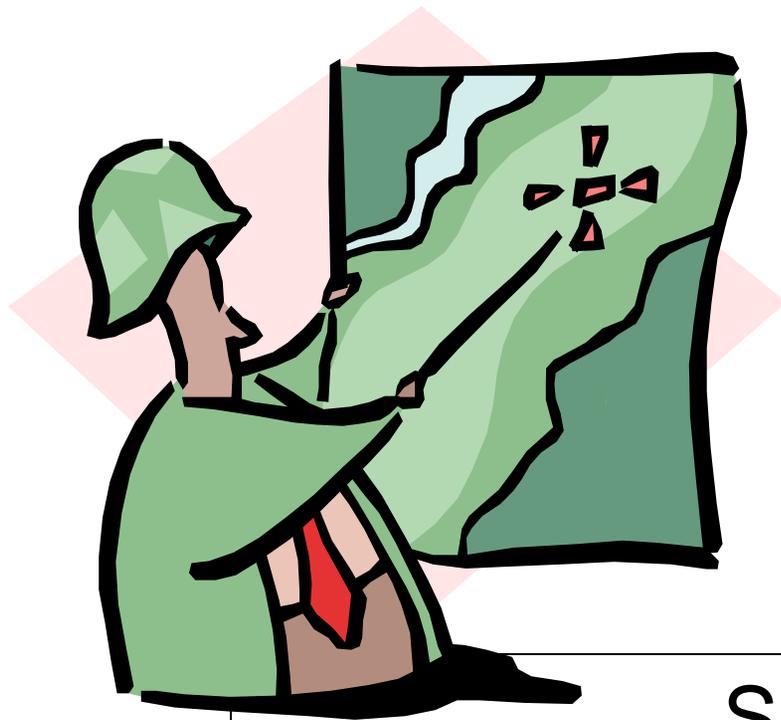
- Necessary to document data quality
 - Sections (3,4,and 5) describe the required assessments
- Monitoring organization QAPPs and QMPs should describe assessments performed at local levels.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day





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



*2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day*



Sec 2 Major Elements

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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



2.1 QMPs, QAPPS and SOPs



QMP - Organization Specific

- Describes organizations quality system
- Establishes capability

QAPP - Project Specific

- Identifies the reasons for collecting data and for collecting it in a specific way
- Documents how the data are collected and how quality is maintained

SOP - Instrument/Method Specific

- Ensures consistency
 - From day to day
 - From one person to the next



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Quality Management Plans

<u>Purpose:</u>	To document how an organization will plan, implement, and assess its Quality System
<u>Responsibility:</u>	Monitoring Organization Senior Management
<u>Documentation:</u>	EPA Users: <i>EPA Quality Manual for Environmental Programs</i> (CIO 2105 formerly EPA Order 5360) Extramural Users: <i>EPA Requirements for Quality Management Plans (QA/R-2)</i> http://www.epa.gov/quality/qa_docs.html
Approval:	EPA Regional Administrator or delegated authority
Flexibility:	Rule of thumb – separate QMP and QAPPs. Region may allow small orgs or those that do infrequent work to combine QMP and QAPP into one document.
Based on Regional policy	Based on details of QMP the Region may delegate QAPP review and approval of QA to Monitoring Org.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Quality Assurance Project Plans

Purpose: A document that describes the technical and quality activities of an **environmental data operation** (project) that should be implemented to ensure that the results of the work performed **will satisfy the data user's needs**

Responsibility: Monitoring Organization Technical Project Staff

Documentation: EPA Users: *EPA Quality Manual for Environmental Programs* (CIO 2105 formerly EPA Order 5360)

Extramural Users: *EPA Requirements for Quality Assurance Project Plans* (QA/R-5) http://www.epa.gov/quality/qa_docs.html

Approval: EPA Regional Administrator or delegated authority; possibly Monitoring Org.
Must be approved before the start of an EDO
EPA Tracks Approval on AMTIC



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Four Main QAPP Topic Areas:

Plan → Implement → Assess → Report

- | | |
|----------------------------------|-------------------|
| A. Project Management | 9 elements |
| B. Data Generation/Acquisition | 10 elements |
| C. Assessment and Oversight | 2 elements |
| D. Data Validation and Usability | <u>3 elements</u> |
| | 24 Total |



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



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

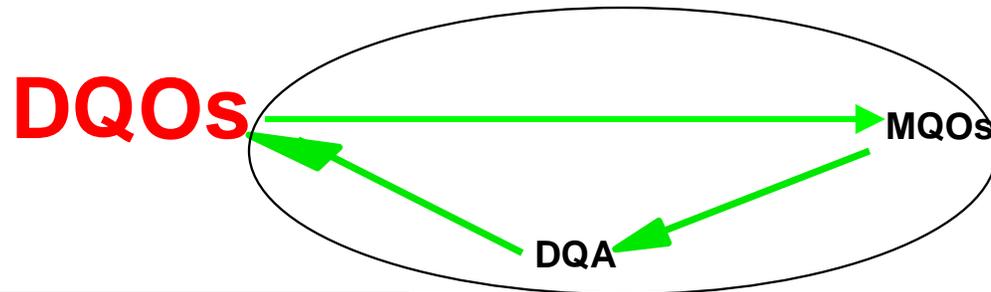


2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



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?

7-Step 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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



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
- Assessment statistics discussed in Section 4 of Appendix A



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Interlude Discussion: Measurement Quality Objectives and Data Validation Templates

- **MQOs are QA performance and operational criteria that are used to evaluate the acceptability of QA/QC data, which evaluate the acceptability of the network monitoring 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.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



WHERE DO MQOS COME FROM?

- EPA has set Data Quality Objectives which are statements of **DECISION ERROR**:
 - Objective that decisions on attainment will be correct at least 95% of the time
 - Ozone, PM2.5, Pmcoarse, and Pb
 - The MQOs are derived from this decision error goal



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



MQOS

- Are PERFORMANCE REQUIREMENTS:
 - PM2.5 (auto and manual) goals for measurement uncertainty are 10% for total precision and +/- 10% for total bias
 - Ozone precision goal is a 90% conf limit of 15% for the CV, and 95% conf limit for the absolute bias of 7%
 - Transl: 90 times out of 100 the CV is $\leq 15\%$



THEN, THESE MQOS ARE USED IN THE VALIDATION TEMPLATES

- Validation templates in Appendix D of Redbook
- Validation templates include instrument/method-specific recommendations as well as MQOs
- The MQOs are all calculated from the difference between your instrument's indicated value and the known (audit) value = \mathbf{d}_i
- Both precision (wiggle) and bias (jump) from \mathbf{d}_i
- Use the DASC excel file to calculate



VALIDATION TEMPLATES

- 11 separate tables
- All gaseous, PM2.5 auto and manual, PM10 dichot, hi-vol, auto, LTP and STP
- 3 levels of data validation (review):
 - Critical
 - Operational
 - systematic



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



- **Critical**

- Every point or subset of hourly values must meet each criterion

- **Operational**

- There *might* be a problem, and there must be justification for using these data

- **Systematic**

- Important for interpreting the set of data (e.g., 75% completeness)

Ozone Validation Template

Requirement	Frequency	Acceptance Criteria
CRITICAL CRITERIA-Ozone		
One Point QC Check Single analyzer	1/2 weeks	$\leq \pm 7\%$ (percent difference)
Zero/span check	1/2 weeks	Zero drift $\leq \pm 2\%$ of full scale Span drift $\leq \pm 7\%$

- 1-pt QC checks no longer called precision checks, because the results are used (by YOU) to calculate both precision and bias
- Each check $\leq 7\%$ is the CRITICAL criteria for each set of data since last passing check



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



O3 OPERATIONAL:

Shelter Temperature	
Temperature range	Daily (hourly values)
Temperature Control	Daily (hourly values)
Temperature Device Check	2/year

Precision(using 1-point QC checks)

90% CL $CV \leq 7\%$

Bias (using 1-point QC check)

95% CL $\leq \pm 7\%$



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



MORE O3 OPERATIONAL:

Annual Performance Evaluation		
Single analyzer	Every site 1/year 25 % of sites quarterly	Percent difference of each audit level \leq 15%
Primary QA Organization (PQAO)	annually	95% of audit percent differences fall within the one point QC check 95% probability intervals at PQAO level of aggregation
Federal Audits (NPAP)	1/year at selected sites 20% of sites audited	Mean absolute difference \leq 10%



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day



OZONE SYSTEMATIC:

- Completeness
- Siting
- Sample residence times
- That EPA keeps up its end and gets the SRP that you use recertified



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



2ND EXAMPLE: PM_{2.5} CONTINUOUS:

- **CRITICAL:**
 - 23-25 hours in daily value
 - Flow rate avg $\leq 5\%$ of 16.67
 - Flow rate variability CV $\leq 2\%$
 - One-point flow rate verification monthly $\pm 4\%$ of transfer standard
 - THIS FR VERIFICATION IS USED TO ESTIMATE BIAS (MQO)
 - BAM membrane check

PM2.5 CONTINUOUS OPERATIONAL:

- Leak checks, cleaning at intervals
- Temp and pressure checks and calibration
- Flow Rate verifications and, if needed, calibrations
- COLLOCATED RESULTS
 - Every 12 days for 15% of sites
 - Results > 3 used to CALCULATE PRECISION (MQO) of a CV of 10%



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



PM2.5 CONTINUOUS SYSTEMATIC

- Completeness
- Detection limits
- Getting your standards recertified
- Overall PRECISION for each site and PQAO based on collocated results
- Overall BIAS for each site and PQAO based on PEP results (+- 10%)



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



2.4 National Performance Evaluation Program What and Why?

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

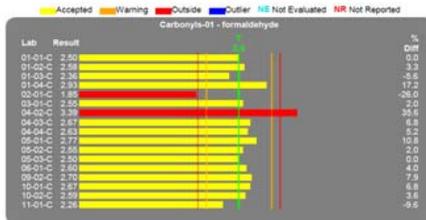
NPAP-TTP



PEP



Protocol Gas



**NATTS PT &
ORIA Round Robins**



SRP



PAMS Cylinders



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day



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.



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



CFR Language on PEP/NPAP Responsibilities

- Promulgated in October 17 2006 Federal Register
- 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 Covered in Section 3.2
- Audits must be adequate & independent
 - Some of this defined in guidance, some in the regulation



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Adequate NPAP/PEP (abridged version)

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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



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



2.5 Technical Systems Audits

- A systematic and objective examination to determine:
 - whether environmental data collection activities comply with the project's QA Project Plan,
 - whether QAPP procedures are implemented effectively,
 - and whether they are sufficient and adequate to achieve the Project's data quality goals



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Type 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)



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Frequency of TSAs

- NAAQS pollutants – Regulation requires EPA to conduct an Organizational TSA of each monitoring organization at least every 3 years
- Non-NAAQS - Program specific TSAs audits are conducted every 1 – 3 years
- Internal TSAs – (State, Local, and Tribal) QA Manager or QAPP defines the frequency

Note: Field audits are a separate requirement covered under Section 3



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Guidelines for TSAs

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

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



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



2.6 Gaseous and Flow Rate Audit Standards

2.6.1 Gaseous and Flow Rate Audit Standards. **Gaseous pollutant concentration standards** (permeation devices or cylinders of compressed gas) used to obtain test concentrations **for CO, SO₂, NO, and NO₂ must be traceable to** either a National Institute of Standards and Technology (NIST) **Traceable Reference Material** (NTRM), NIST Standard Reference Materials (SRM) and Netherlands Measurement Institute (NMI) Primary Reference Materials (valid as covered by Joint Declaration of Equivalence) or a NIST-certified Gas Manufacturer's Internal Standard (GMIS), certified in accordance with one of the procedures given in reference 4 of this appendix. **Vendors advertising certification with the procedures provided in reference 4 of this appendix and distributing gases as "EPA Protocol Gas" must participate in the EPA Protocol Gas Verification Program or not use "EPA" in any form of advertising.**

Hence -The New Ambient Air Protocol Gas Verification Program



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



AA-PGVP Goal

Each year, EPA will attempt to compare gas cylinders from every specialty gas supplier being used by ambient air monitoring organizations.

More details in gas audit discussions!!!



2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



Ozone Standards (2.6.2)

- Must follow UV photometric calibration procedures 50 CFR Part 50 App D
 - New Ozone calibration guidance on AMTIC
<http://www.epa.gov/ttn/amtic/srpqa.html>

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.



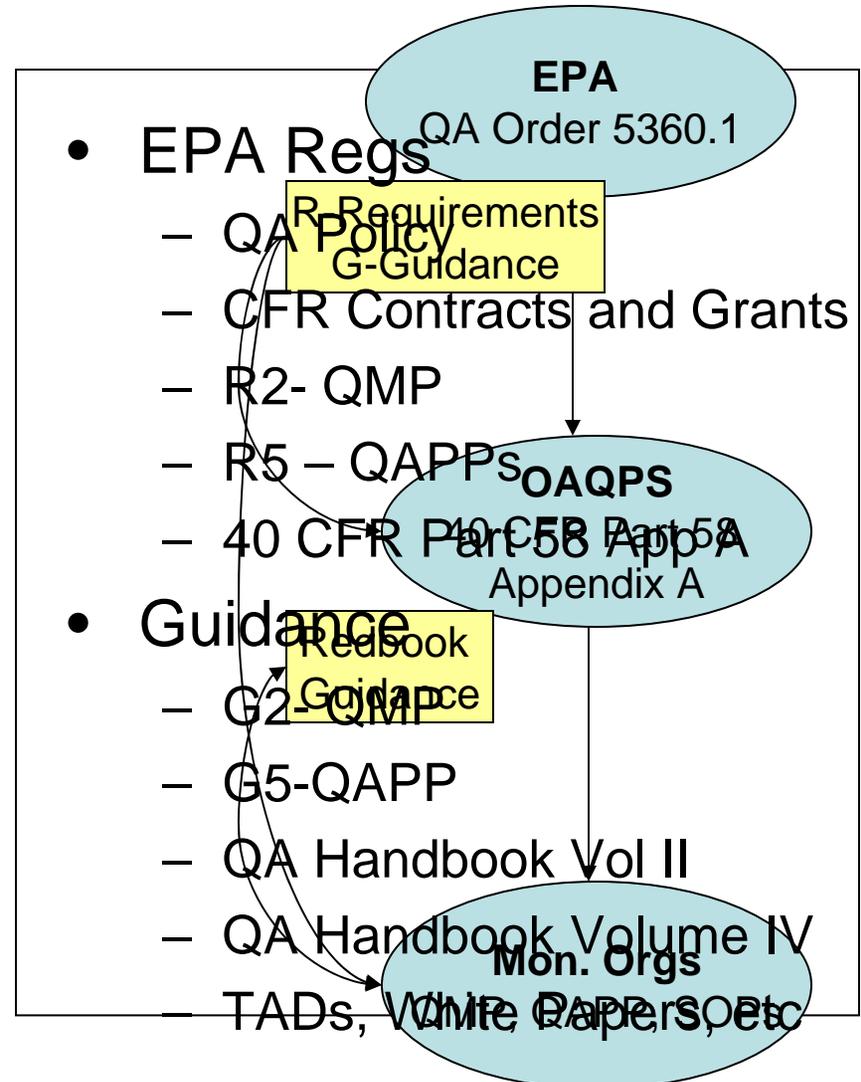
2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



2.7 Requirements and Guidance

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



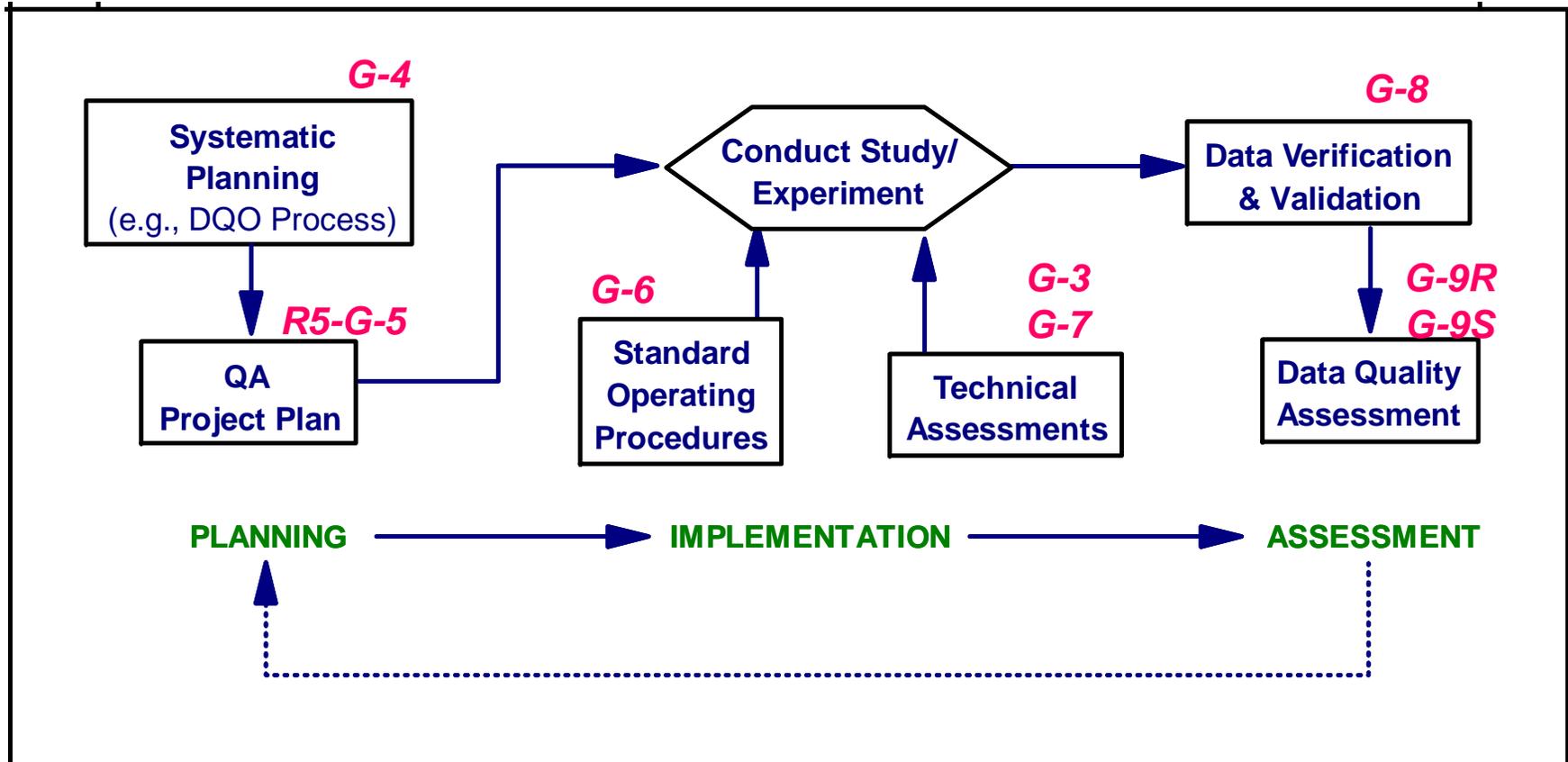
2009 National Ambient Air Monitoring Conference, Nashville, TN

Appendix A in Half-a-Day



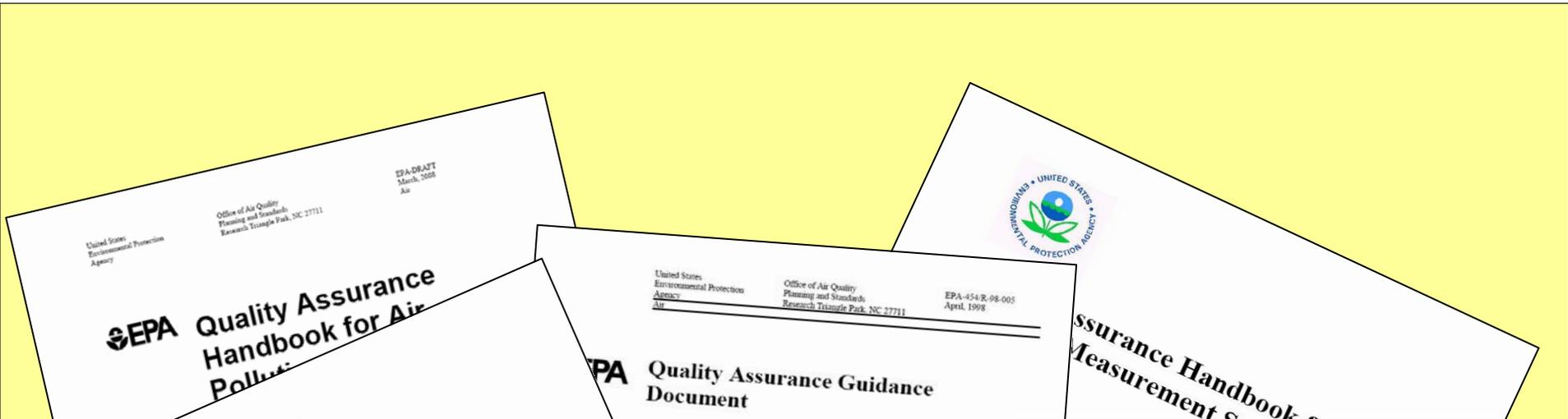
EPA Guidance for planning, implementation, and assessment activities.

http://www.epa.gov/quality1/qa_docs.html



2009 National Ambient Air Monitoring Conference, Nashville, TN
Appendix A in Half-a-Day







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

Version 1.1



United States Environmental Protection Agency
Research and Development

Human Exposure and Atmospheric Sciences Division
National Exposure Research Laboratory
Research Triangle Park, NC 27711
November 1998

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 Allotropy of Filters	12



2009 National Air Quality Conference

April 15-17, 2009

IV

