



Technical Systems Audits

QA 101 Session



Greg Noah, EPA OAQPS, RTP, NC
Stephanie McCarthy, EPA Region 4, SESD, Athens, GA

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Technical Systems Audits (TSAs)

Let's break it into 3 parts...

- ✓ What is a TSA, background, why do we do them?
- ✓ How do you conduct a good and effective TSA? Tools for conducting audits?
- ✓ Real world audit findings!
(Names changed to protect the guilty)



What is a TSA?



40 CFR Part 58, Appendix A Section 2.5 says...

*Technical Systems Audit Program. Technical systems audits of each ambient air monitoring organization **shall** be conducted at least every 3 years by the appropriate EPA Regional Office and reported to the AQS. Systems audit programs are described in reference 10 of this appendix. For further instructions, monitoring organizations should contact the appropriate EPA Regional QA Coordinator.*

Yeah ok... So what's "reference 10"?

What is a TSA?



**Reference 10 is...
The Quality Assurance
Handbook for Air Pollution
Measurement Systems,
Volume II**

Otherwise known as
“The QA Handbook”



**Quality Assurance
Handbook for Air
Pollution Measurement
Systems**

Volume II

**Ambient Air Quality
Monitoring Program**

What is a TSA?



“And the Redbook says...”

Section 15.3 Technical Systems Audit

“A systems audit is an on-site review and inspection of a monitoring organization’s ambient air monitoring program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data.”



What is a TSA?



The QA Handbook states that a TSA should address and report on the following key areas:

- Planning
- Field Operations
- Laboratory Operations
- Quality Assurance/
Quality Control
- Data Management
- Reporting



What is a TSA?



Planning

- Network Design
- Monitoring Strategy
- Representativeness
- Meeting Monitoring Requirements
- Funding Needs
- Resources (Staffing, Equipment)



What is a TSA?



Field Operations

- Use of approved analyzers and samplers for monitoring objective (FRM,FEM)
- Use of analyzers and samplers according to FRM/FEM requirements
- Following documented sampling procedures
- Proper siting of monitoring stations, samplers, and probes
- Maintenance capacity
- Cross-training
- Site housekeeping
- Age of equipment
- Site safety concerns



What is a TSA?



Laboratory Operations

- Use of appropriate analytical equipment
- Following documented analytical procedures
- Cross-training
- Maintenance capabilities
- Housekeeping
- Age of equipment
- Sample storage



What is a TSA?



Quality Assurance and Quality Control

- Approved and updated QMP and QAPP
- Consistent with EPA's Quality System
- Independence
- Proper collocated sampling
- QC checks (zero/precision/span checks, calibrations, etc) conducted properly
- QC checks conducted at the correct frequency
- Documented QA data reviews
- Separate instruments and standards for QA
- Review of electronic traces
- Audits



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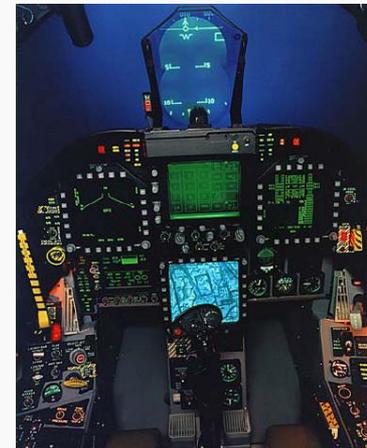


What is a TSA?



Data Management

- Data acquisition system
- Data backup
- Data flow SOP or flowchart
- Organization (can documentation actually be found?)
- Minute data
- Archival (paper and electronic)

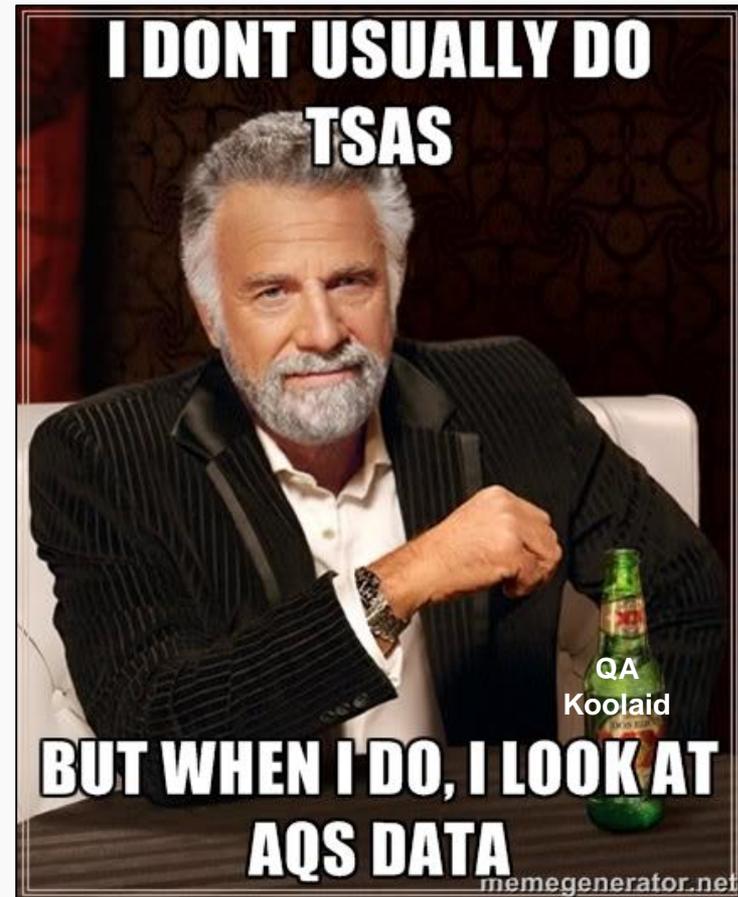


What is a TSA?



Reporting

- Data in AQS
- Timely reporting
- Correct flagging
- Correct null coding
- Metadata
- Certification
- AIRNow



What is a TSA?



TSA References

40 CFR Part 58, Appendix A, Section 2.5

Regulations - Requirements that *must* be followed

QA Handbook Section 15.3

Guidance and details on how best to perform a complete and effective audit

Who Audits Who?

Back to 40 CFR Part 58, Appendix A:

“Technical systems audits of each ambient air monitoring organization shall be conducted at least every 3 years by the appropriate EPA Regional Office and reported to the AQS.”

The EPA Regional Offices have the responsibility to audit each air monitoring organization (this includes Locals) in their respective regions.

But at what frequency?



When Do We Do TSAs?



- The EPA Regional staff are **required** to conduct TSAs on ambient air monitoring organizations in their respective regions every 3 years
- EPA Regional staff may follow up with more frequent TSAs if deficiencies are noted that require attention





How to Conduct Effective TSAs

- Tools!
- Pre-audit activities
- On-site assessment & interviews
- Post-audit activities

TSAs cover a lot of territory in a short amount of time! It is important to be prepared and organized!





QA Handbook TSA Audit Form Appendix H

“TSA Questionnaire”

- Or, modify it to your agency's needs!

III) CALIBRATION

Please indicate the frequency of multi point calibrations.

Pollutant	Frequency	Name of Calibration Method

d) Planning Documents including QMP, QAPP, & SOP

c) Independent Quality Assurance and Quality Control

1. Status of Quality Assurance Program

Question	Yes	No	Comment
Does the agency perform QA activities with internal personnel? If no go to Section d.			
Does the agency maintain a separate laboratory to support quality assurance activities?			
Has the agency documented and implemented specific audit procedures separate from monitoring procedures?			
Are there two levels of management separation between QA and QC operations? Please explain:			
Does the agency have identifiable auditing equipment and standards (specifically intended for sole use) for audits?			

2. Internal Performance Audits

Question	Yes	No	Comment
Does the agency have separate facilities to support audits and calibrations? If the agency has in place contracts or similar agreements either with another agency or contractor to perform audits or calibrations, please name the organization and briefly describe the type of agreement.			
If the agency does not have a performance audit SOP (included as an attachment), please describe performance audit procedure for each type of pollutant.			
Does the agency maintain independence of audit standards and personnel?			
Please provide information on certification of audit standards currently being used. Include information on vendor and internal or external certification of standards.			
Does the agency have a certified source of zero air for performance audits?			
Does the agency have procedures for auditing and/or validating performance of Meteorological monitoring? Please provide a list of the agency's audit equipment and age of audit equipment.			

Date of Latest Approval:

Date of Latest Revision



Individual Method Checklists

United States
Environmental Protection
Agency

Research and Development

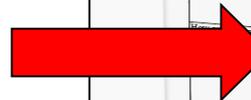
Human Exposure and Atmospheric Sciences Division
National Exposure Research Laboratory
Research Triangle Park, NC 27711

November 1998

Quality Assurance Guidance Document 2.12

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

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Analyst: _____ Audit Date: _____
 Location: _____ Auditor: _____

Audit Questions	Response			COMMENTS
	Yes	No	NA	
I. Routine Operations & Site Housekeeping				
Are any visible sources that may impact the weigh lab. Are anti-static prevention devices in place? Is the room access restricted? Is the equipment located inside the weigh room only that which is required for daily operations?				
List the model and serial numbers for the balance, temperature and humidity sensors utilized in the weigh room.				
Which room conditions monitored? When do these occur?				
Is a LIMS utilized to monitor temperature and RH readings? What procedure is utilized to verify these readings and at what frequency?				
Is a data logger utilized to monitor temperature and RH readings? What procedure is utilized to verify these data logger values? At what frequency are these procedures performed?				
Is the temperature maintained at 20-23°C with a temperature control range of ± 2°C over a 24 hour period? How and where is this data documented? At what frequency is this data reviewed?				
If the temperature is found to be out of tolerance, what corrective action is taken?				
Is the relative humidity maintained at 30-40%, with a standard deviation of ± 2% over a 24 hour period? How and where is this data documented? At what frequency is this data reviewed?				
If the relative humidity is found to be out of specification, what corrective action is taken?				
What is being done to control drafts in the weigh room? Is the microbalance located so that it is not in the draft area? Describe its condition.				

Utilize those available or make your own!



Plan & Organize

- Review the agency's monitoring network
 - Does the agency have a PM_{10} or $PM_{2.5}$ weigh lab?
 - Does the agency do trace-level or near-road monitoring?
 - Does the agency participate in NATTS or special purpose toxics monitoring?
 - Is there an analytical lab involved?
- Know the methods you are auditing!





Balance Resources



- How much time do you need to complete your audit?
 - Recommend at least one week per agency
- Based on the size & scope of the network, do you have the right team of auditors assembled?
- Talk to your management if you think you may need additional time or resources
- Complete as much prep work as you can in-house, in order to optimize time available in the field



Communicate with the Agency



- Schedule the audit with the agency
- Send the agency contact your TSA questionnaire a month or more in advance of the audit
- Request copies of their current quality documents
- Request a link to their annual network plan



Do Your Homework!



- QAPP and SOPs
 - Are any of these documents more than 5 years old?
 - Have they been approved by EPA? If not, why?
 - Do the stated procedures meet method requirements? FRM/FEM specifications?
 - Are there details within the documents?
- Earmark any “red flags” within the quality documents as future questions to be asked during the TSA



- Review the responses provided by the agency in the TSA questionnaire
 - Do the responses line up with the QAPP/SOPs you have reviewed?
 - Were any questions left blank?
 - Do any answers make you go “Hmmm?”
- Earmark answers (or blanks) in the questionnaire for follow-up





Review Data!!

- Pull the agency's data from AQS
 - AMP 350 (Raw Data Report)
 - AMP 251 (QA Raw Data Assessment Report)
 - AMP 256 (QA Data Quality Indicator Report)
 - AMP 430 (Data Completeness Report)
 - AMP 480 (Design Value Report)
 - AMP 300 (Violation Day Count Report)
 - AMP 503 (Extract Sample Blank Data)
 - AMP 504 (Extract QA Data)
 - AMP 600 (Certification Evaluation & Concurrence)
- Mark data that catch your eye!



Conducting TSAs: Pre-Audit



The AMP 350 Tells a Story

Code change?

What malfunctioned?
Where is maintenance & recalibration?

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	5.5	1.8	3.2	2.9	3.2	2.1	2.3	3.4	7.1	5.6	2.9	2.7	2.1	3.2	5.7	8.1	11.0	2.7	1.7	2.3	2.2	1.8	2.4	3.0	24	11.0		
2	4.7	4.1	4.1	5.5	5.2	3.6	1.3	2.0	2.9	2.2	1.9	1.0	.9	.7	.7	.8	.6	.6	.6	.6	.5	.6	.8	1.0	24	5.5		
3	1.5	.9	.7	.7	.6	.8	.6	1.0	1.0	.7	1.3	1.1	1.5	1.0	.9	.5	.5	.5	.4	.5	.5	.4	.5	.4	24	1.9		
4	1.5	.7	.5	.4	.4	.4	.4	.4	.8	2.5	3.6	4.9	8.6	1.0	.9	.8	.7	.7	.7	.8	.5	.4	.5	.4	24	8.6		
5	2.6	1.0	.7	.6	.6	.6	.7	.7	.9	1.1	1.9	2.7	BF	AN	12	2.7												
6	AN	0																										
7	AN	BA	BA	BA	AN	BC	BC	BL	AN	0																		
8	AN	BA	BC	BC	AN	0																						
9	AN	AS	0																									
10	AS	0																										
11	AS	0																										
12	AS	0																										
13	AS	AY	AS	AY	AY	0	.7	.3	.2	.1	.4	.3	.2	.3	.5	.4	11	1.0										
14	4.3	1.6	1.0	1.2	1.5	1.3	1.3	1.2	1.4	1.9	2.9	2.4	2.1	2.4	2.0	1.8	1.6	1.4	1.5	2.4	4.3	3.5	2.3	1.4	24	4.3		
15	4.4	1.7	1.5	1.2	1.2	.5	.5	.6	2.3	4.3	4.4	4.7	8.5	13.2	12.9	10.1	8.1	8.3	5.7	2.1	.8	.5	.4	.4	24	13.2		
16	4.6	1.4	.7	.5	.5	.4	.6	.5	.4	1.0	4.9	8.5	8.8	6.2	5.3	4.9	17.6	21.7	6.7	2.6	1.6	1.7	2.0	2.2	24	21.7		
17	4.0	1.5	.9	.8	.8	.7	.6	.5	.5	2.8	4.7	4.1	3.7	3.3	3.1	2.8	2.4	1.9	1.5	1.4	1.2	1.1	1.1	1.0	24	4.7		
18	3.6	1.9	1.5	1.1	.6	.9	.9	.9	.8	2.1	3.9	6.3	12.9	8.9	6.7	5.7	6.5	5.5	3.1	1.8	1.1	.5	.4	.3	24	12.9		
19	3.7	1.1	.7	.7	.7	.6	.6	.5	.7	1.8	3.4	7.0	BF	10.0	6.7	4.0	3.3	3.0	2.9	2.8	2.3	2.1	1.7	1.6	23	10.0		
20	3.8	2.5	1.8	1.6	1.7	1.0	.7	.6	1.2	3.0	3.7	6.5	9.2	8.7	7.3	8.0	6.1	5.0	5.4	6.0	5.8	4.9	4.6	3.1	24	9.2		
21	3.8	1.9	1.4	.9	.8	1.3	1.0	.9	1.4	1.6	2.4	4.7	7.8	10.7	6.6	5.1	4.2	2.5	1.9	1.7	1.2	.7	.5	.5	24	10.7		
22	3.1	1.2	.8	.7	.8	.4	.5	.5	.7	.6	1.0	7.4	28.6	18.1	9.2	4.3	2.5	1.5	1.3	1.3	1.5	3.2	4.0	2.9	24	28.6		
23	4.1	4.7	12.5	13.1	8.0	2.5	2.0	1.0	.3	.3	.2	.1	.2	.1	.1	.9	.1	.0	.0	.0	.0	.1	.1	.0	24	13.1		
24	1.5	.5	.3	.1	.0	.0	.2	.1	.3	.6	.4	.3	.4	.1	.1	.1	.0	.0	.0	.0	.0	.0	.0	.0	24	1.5		
25	3.2	1.3	1.1	2.3	3.2	3.2	3.6	3.9	5.0	3.5	3.5	10.4	6.3	4.4	4.3	4.4	4.9	2.8	2.6	1.8	1.9	1.4	.9	.8	24	10.4		
26	2.4	1.0	.6	.3	.3	.4	.3	.6	.6	1.4	2.2	2.1	2.7	3.3	2.1	1.7	2.1	2.8	4.6	5.5	1.9	1.2	1.4	2.2	24	5.5		
27	3.6	1.1	.7	.4	.3	.1	.2	.2	.4	5.4	5.6	4.9	13.3	5.4	1.1	.5	.2	.1	.2	.0	.0	.0	.0	.0	24	13.3		
28	4.0	1.2	.9	.6	.5	.6	.4	.4	.5	.5	1.4	8.2	6.7	3.6	2.5	1.9	2.1	2.0	1.1	.5	.2	.1	.3	.2	24	8.2		
29	3.3	1.2	.7	.7	.6	.6	.8	.6	1.4	1.7	2.1	23.0	16.1	27.1	23.7	14.1	10.0	14.7	4.1	2.4	1.4	1.4	1.9	4.3	24	27.1		
30	7.9	4.0	2.8	2.5	2.4	2.2	2.3	3.6	6.4	5.3	4.6	3.6	2.6	2.4	2.4	4.4	7.2	2.3	1.2	1.0	.9	.7	.4	.4	24	7.9		

Mark charts needing further review at the agency



Sort the Data in Excel

Action Type	Site	Param	POC	Date	Days	Method	Unit	Monitor Conc	Actual Conc	% Diff
1-Point QC	3002	44201	1	17-Jul-13	15	047	008	73.4	75	-2.1%
1-Point QC	3002	44201	1	22-Jul-13	5	047	008	74.4	75	-0.8%
1-Point QC	3002	44201	1	22-Jul-13	0	047	008	74.8	75	-0.3%
1-Point QC	3002	44201	1	31-Jul-13	9	047	008	73	75	-2.7%
1-Point QC	3002	44201	1	8-Aug-13	8	047	008	82.4	75	9.9%
1-Point QC	3002	44201	1	8-Aug-13	0	047	008	75	75	0.0%
1-Point QC	3002	44201	1	21-Aug-13	13	047	008	74.4	75	-0.8%
1-Point QC	3002	44201	1	9-Oct-13	49	047	008	105	75.6	38.9%
1-Point QC	3002	44201	1	9-Oct-13	0	047	008	74	75.6	-2.1%
1-Point QC	3002	44201	1	14-Oct-13	5	047	008	41.8	76.2	-45.1%
1-Point QC	3002	44201	1	14-Oct-13	0	047	008	75.8	75.8	0.0%
1-Point QC	3002	44201	1	30-Oct-13	16	047	008	75	75.8	-1.1%
1-Point QC	3002	44201	1	19-Nov-13	20	047	008	74	74.8	-1.1%



Summary Hit List

- Rank & prioritize your initial findings
- Pack your briefcase (and laptop!)
 - Agency TSA questionnaire response
 - Blank checklists & field logbooks for audit notes
 - Quality documents
 - Data package
 - Camera
 - Range Finder





Audit Time!

- Entrance interview with management
- Take the office tour!
 - File Room
 - Repair shop
 - Certification shop
 - Warehouse
 - Laboratory





Have a Scribe!

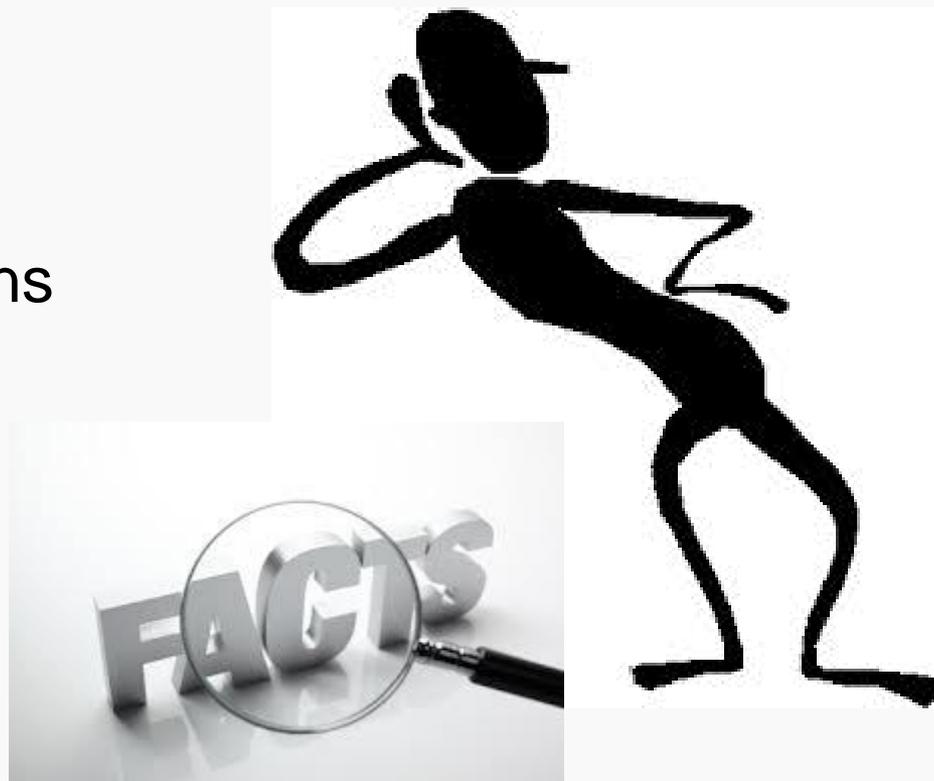


- Document your findings – be specific and detailed!
- Have teammates record observations, as well as take notes during interviews with staff
- Notes from all auditors can be combined post-audit to make report writing easier!



Talk to the Staff

- Go over the TSA questionnaire
- Ask clarifying questions from SOP review
- Interview staff who actually do the work
- Listen closely
- Trust, but verify!





Agency Records Review



- Ask to see certification records from each pollutant category
- Choose sites at random
- Have agency staff pull 3 years of records
- Expiration dates?
- Are standards traceable?
 - Photometers
 - Gas Calibrator Flows
 - Other flow devices
 - Thermometers
 - Barometers
 - Check weights





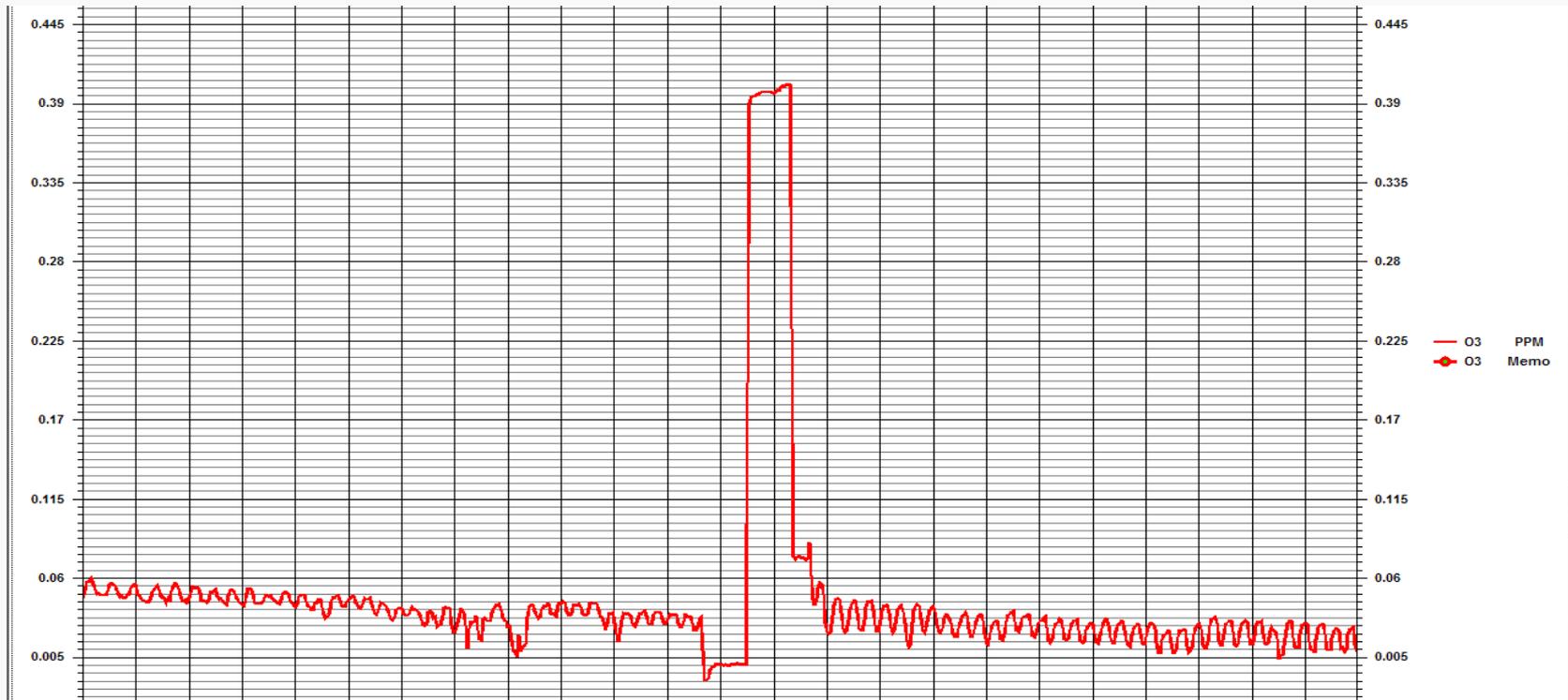
Agency Records Review



- Ask to see records for all data marked during pre-audit activities
- QA/QC Records
 - Calibrations
 - Verifications
 - Maintenance
- Is there enough detail in the records that you can **easily** recreate events & justify null value codes?



Review Minute Data!

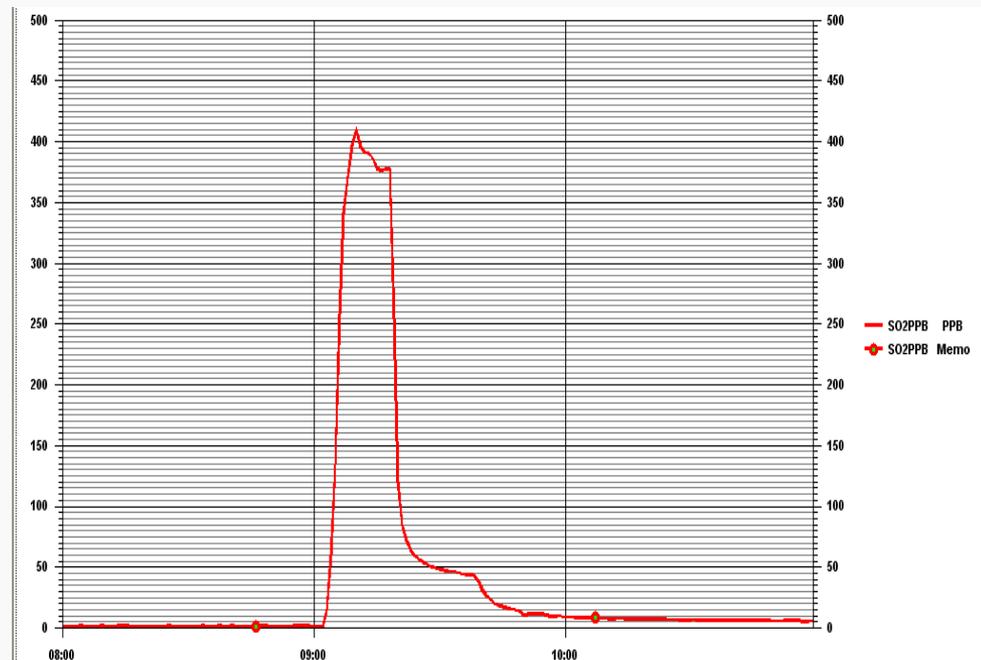


It will illuminate problems that daily summary (hourly) reports will mask!



Review Minute Data!

- Shows the stability of QC checks
 - Adherence to SOPs?
 - Good quality procedures?
- Opportunity to talk to QA staff and learn & observe their data handling procedures





Even More Records...

- Logbooks
- Chain of custody
- If it's not documented, it didn't happen!





Visit Field Sites

- Spread out!
 - Don't just visit the sites that are near the central office!
 - Visit multiple sites, if possible, to get a well-rounded view of the network
 - Auditors can break into teams, if needed, in order to maximize time





Field Operations

- Housekeeping
- Review logbooks and records on site
- Talk to the field technician!
 - Demonstrate procedures?
- Evaluate Appendix E criteria





Exit Interview



- Pre-meeting with team to summarize findings
- Be prepared to discuss potential corrective actions
- Have the right people in the room
- Clearly communicate the findings
- Be factual and professional



Post-Audit Activities

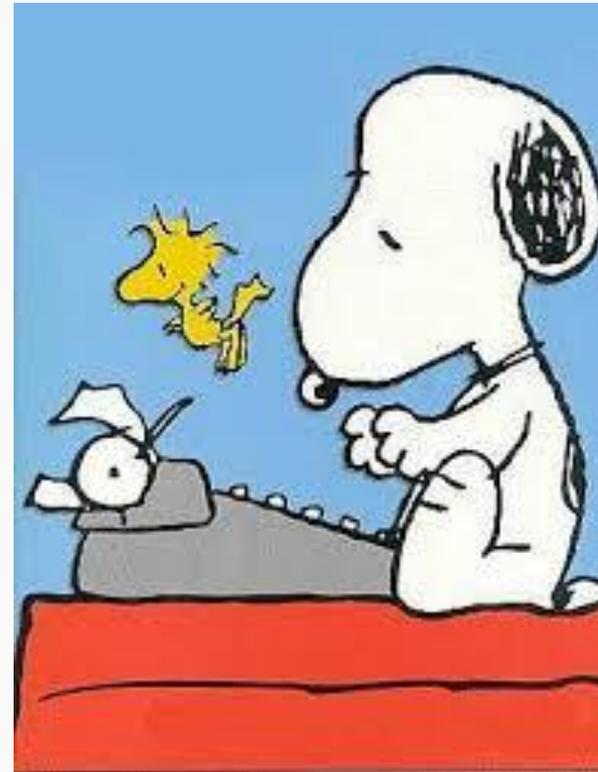
- You can't account & plan for everything in a TSA
 - Findings revealed on-site (unplanned) may require additional attention
 - Some findings may need additional research & discussion after you return to your office
- Do you need to make a return trip?
- Talk to management!





Write the Report...

- Immediately upon return to office!
- Provide clear, specific findings & details
 - Why are the findings significant?
- Document areas not reviewed during the on-site assessment, if necessary





Follow-Through



- Audit doesn't end with issuance of report!
- Review agency's response to audit findings
- Assess efficacy of corrective actions for major findings
- Continue to communicate with agency & provide support



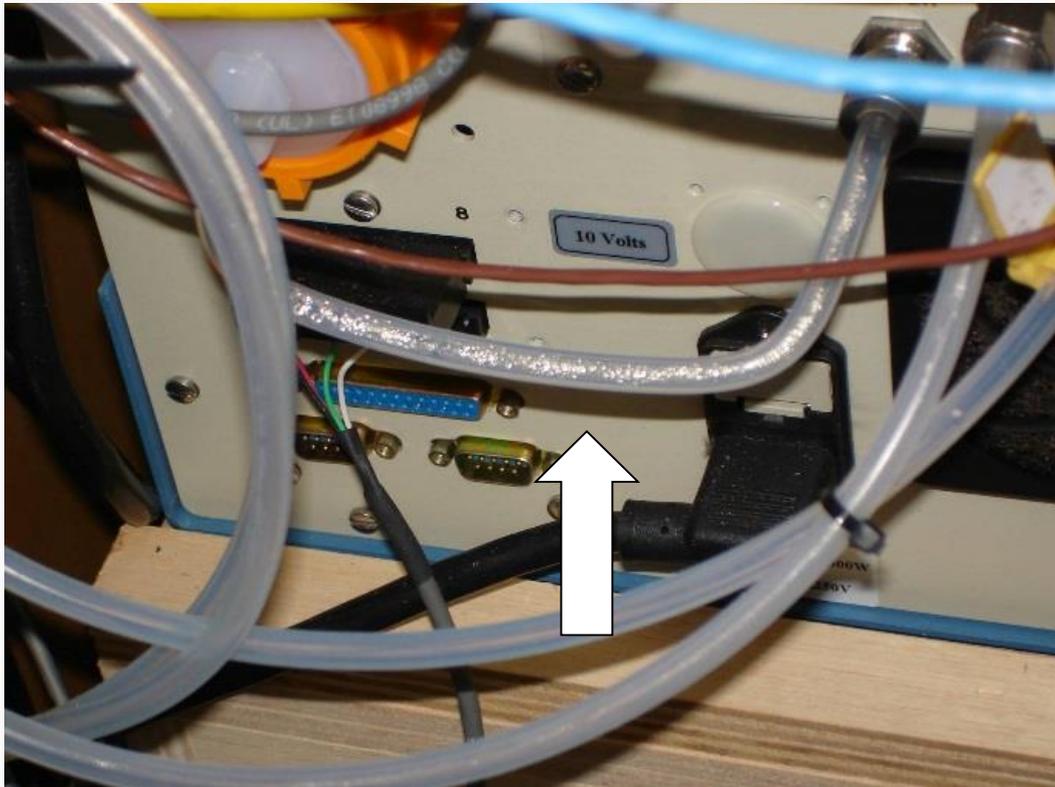
Real World TSA Findings

Things we've found, and how we found them...





Water in Probe Lines



How did we find it?

During the TSA, we visited several monitoring sites in the network. Always look behind the analyzers at the plumbing!

Why is it important?

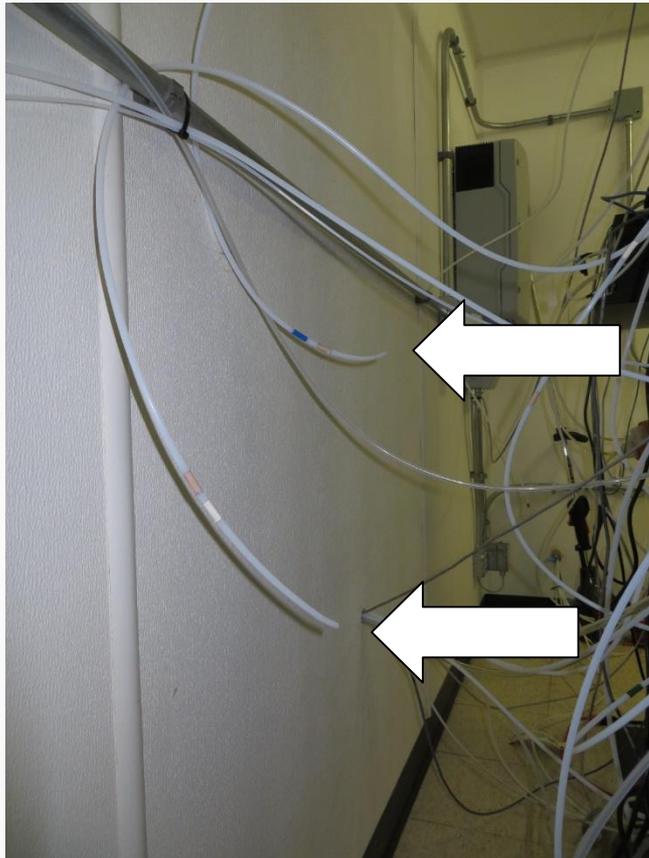
Biases and may invalidate data

Other things to look for:

- Disconnected lines
- Dirty in-line filters
- Worn lines
- Incorrect plumbing



Uncapped Calibration Lines



How did we find it?

Tracing plumbing and sample train

Why is it important?

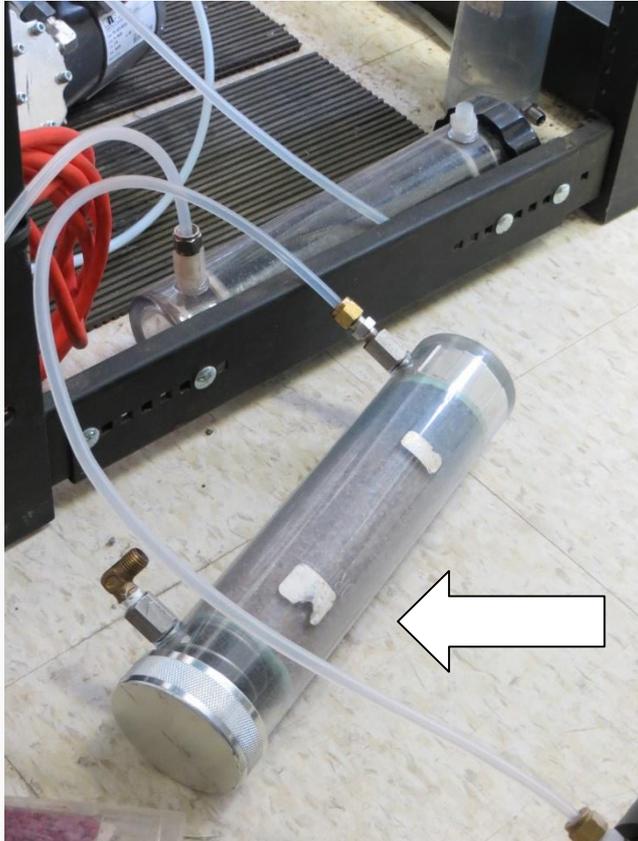
The analyzers are sampling shelter air, which invalidates data

Other things to look for:

- Correct filter placement
- Contamination in the calibration lines



Depleted Silica Gel



How did we find it?

Looking at sampler/analyzer support equipment

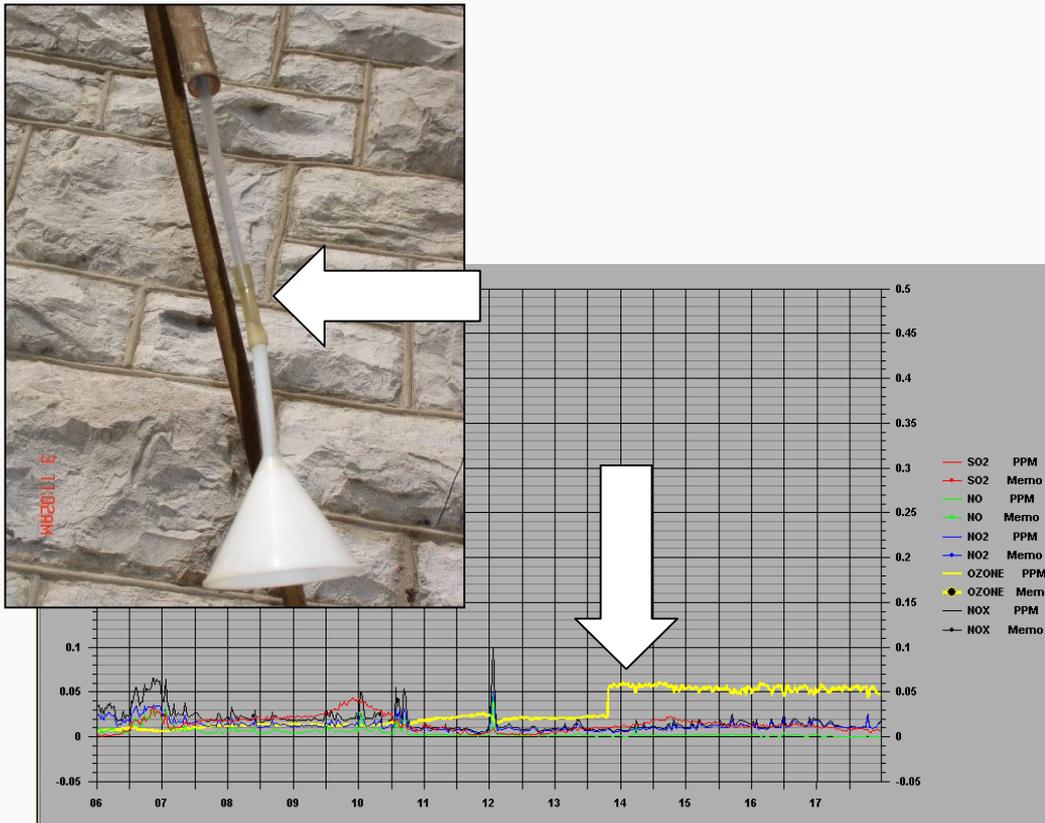
Why is it important?

Helps eliminate condensation in lines, removes water vapor that can give erroneous measurements in the analyzer

Other things to look for:

- Documentation of routine zero air maintenance
- Zero air system appropriate for monitoring objective (trace level/full scale)?

Unapproved Material (Tygon tubing) in Sampling Train



How did we find it?

Pulled the rain shield down from the metal protective conduit to see the actual sampling line

Why is it important?

Tygon will scrub pollutants, biasing data low

Other things to look for:

- Dirty sample lines
- Inappropriate rain shield material
- Probe placement near obstructions and other probes



Smoking in the Shelter



How did we find it?

Site visit; general housekeeping

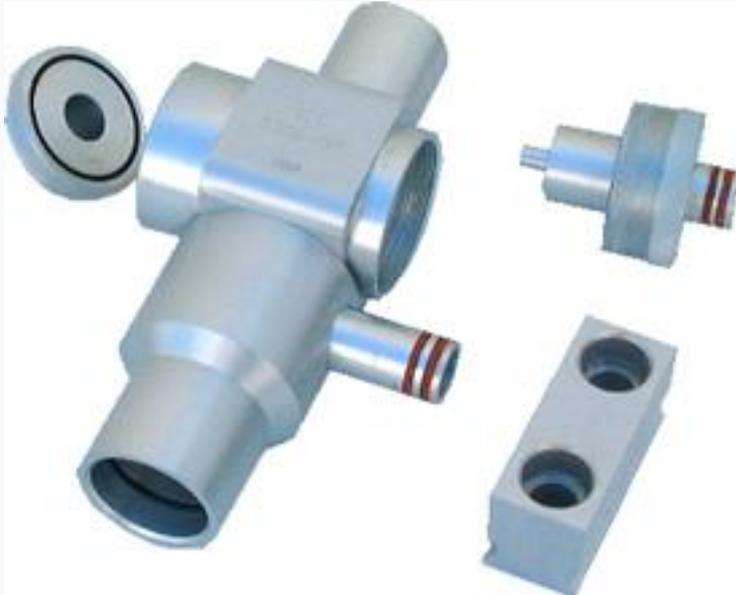
Why is it important?

Seriously?





Dirty Very Sharp Cut Cyclone (not the actual cyclone onsite)



How did we find it?

Traveled to several sites in the network and checked the sampler components

Why is it important?

If the VSCC is dirty, it could change the VSCC cut-point allowing a different size fraction to be collected

Other things to look for:

- Cleanliness of the sampler itself
- Cleanliness of the inlet head
- Documentation of cleaning
- Operator's understanding of maintenance frequencies



PM_{2.5} Sampler Within 10 Meters of the Drip-line of Trees



How did we find it?

Traveled to several sites in the network and measured distances

Why is it important?

The samplers will not sample representative air, calling the data into question

Other things to look for:

- Encroaching trees or vegetation that could be a future problem
- Safety issues onsite
- Sampler distances from each other
- Pollutant sources nearby

Real World Findings – Data Review



“Reviewed data” with no signature or date

How did we find It?

Looked through the data packages to determine if the data review was conducted as written in the SOP

Edited to protect the guilty

Why is it important?

Without a signature and date, there is no way to determine if the data was really reviewed or just put in a folder

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA REPORT
Sep. 9, 2006

DATE	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	QC	WATNCH	
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	AO	9	
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	AO	9	
3	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	9	
4	.027	.026	.025	.021	.021	.016	.012	.010	.016	.030	.039	.039	.038	.038	.037	.036	.034	.033	.026	.025	.031	.033	.032	.032	24	.039	
5	.016	.016	.016	.016	.015	.014	.011	.020	.036	.039	.043	.039	.039	.040	.039	.037	.036	.034	.033	.026	.025	.031	.033	.032	.032	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	.025	.021	24	.030
7	.020	.015	.014	.012	.010	.011	.009	.007	.010	.021	.025	.025	.023	.024	.025	.027	.025	.024	.020	.021	.021	.012	.009	.008	24	.027	
8	.009	.009	.014	.009	.008	.007	.006	.006	.017	.027	.029	.030	.029	.030	.032	.030	.029	.027	.023	.023	.024	.022	.017	.010	24	.032	
9	.007	.006	.006	.006	.006	.007	.007	.006	.014	.035	.041	.044	.045	.044	.043	.040	.039	.038	.033	.023	.018	.015	.014	.010	24	.045	
10	.010	.010	.007	.007	.011	.014	.016	.020	.028	.036	.039	.046	.054	.062	.064	.064	.060	.053	.043	.023	.018	.013	.009	.010	24	.064	
11	.007	.002	.017	.016	.017	.013	.008	.013	.020	.031	.041	.047	.048	.049	.049	.048	.048	.044	.039	.034	.030	.041	.030	.024	24	.040	
12	.023	.035	.037	.029	.024	.020	.018	.031	.040	.042	.043	.043	.040	.038	.039	.039	.038	.038	.039	.039	.039	.039	.039	.039	24	.043	
13	.039	.038	.038	.038	.037	.035	.035	.036	.039	.043	.041	.041	.040	.040	.041	.041	.038	.032	.031	.031	.030	.037	.036	.036	24	.041	
14	.037	.036	.036	.030	.021	.028	.026	.020	.022	.034	.037	.036	.036	.033	.032	.031	.030	.029	.025	.030	.035	.033	.033	.033	24	.037	
15	.014	.033	.032	.032	.030	.026	.017	.019	.030	.034	.036	.038	.041	.039	.038	.034	.030	.026	.020	.023	.026	.021	.008	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	.020	22	.038	
18	.030	.027	.027	.022	.019	.017	.014	.026	.026	.032	.035	.033	.037	.035	.031	.030	.024	.028	.028	.025	.027	.028	.026	.024	24	.037	
19	.030	.030	.030	.030	.028	.027	.026	.024	.024	.029	.030	.031	.032	.031	.031	.030	.031	.025	.027	.024	.027	.029	.031	.027	24	.032	
20	.014	.014	.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	.013	.007	.015	.022	.026	.028	.032	.030	.027	.025	.026	.025	.010	.006	.008	.040	.040	.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	.026	.022	24	.045	
23	.021	.020	.028	.031	.030	.026	.024	.023	.025	MB	MB	MB	AD	.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	.040	.051	.052	.051	.050	.047	.044	.039	.037	.036	.039	.039	.037	24	.052	
25	.034	.032	.030	.029	.029	.029	.027	.026	.024	.028	.034	.050	.052	.054	.054	.055	.057	.054	.039	.023	.034	.011	.005	.006	24	.057	
26	.002	.009	.032	.039	.030	.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	.028	.028	.030	.023	.026	.034	.036	.035	.036	.036	.036	.037	.036	.035	.034	.033	.028	.025	.031	.030	.028	24	.042	
28	.027	.028	.031	.030	.029	.029	.029	.035	.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	.029	.024	.024	.027	.025	.021	.020	.021	.015	.021	.020	.014	.010	.010	.009	24	.029	
30	.006	.002	.002	.002	.002	.002	.002	.002	.002	.013	.017	.018	.022	.025	.023	.022	.023	.034	.017	.023	.025	.029	.033	.032	24	.033	
31																											
SD:	27	27	27	27	27	27	27	27	27	26	26	25	26	28	28	28	28	28	28	28	28	28	28	28	28		
MAX:	.042	.039	.049	.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	.0190	.0237	.0314	.0348	.0382	.0391	.0376	.0370	.0360	.0327	.0290	.0261	.0255	.0238	.0246	.0230				
MONTHLY OBSERVATIONS:	654	MONTHLY MAX:	6277	MONTHLY MIN:	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																											

Other things to look for:

- Reviewed QA/QC data
- Data organization
- Documented data review procedure



Problematic Chain of Custody

Filter ID	Cassette ID	Sampling Date
T8034059	RP087410	01/12/2009
T8034061	RP087856	01/13/2009
T8034062	RP087851	01/14/2009
T8034063	RP095192	01/15/2009
T8034064	RP097752	01/16/2009
T8034065	RP087834	01/17/2009
T8034066	RP087370	01/18/2009

Prepared by: [Redacted] lab analyst

Received by: [Redacted] field technician

Handwritten notes: 1/12, 2,3, 2,4, rec'd 1/23, 4, 3, 14, Q176816R, I 8795M, rec'd 78064249, 1/14, 1,0

How did we find it?

Document review

Why is it important?

Legal defensibility

Other things to look for:

- No pencil, white-out used for documentation
- Broken chain
- Random notations on the form
- No clear identifiers



Loss of Personnel, Knowledge, Legacy Documentation



How did we find It?

QA program and network review

Why is it important?

Long term program integrity and continuity

Other things to look for:

- Succession planning
- Cross-training
- Archival procedure
- Understanding of the big picture

TSAs aren't just for EPA...

- One of the best practices an air agency can implement is to conduct **internal systems audits** on a routine basis!
- Include in QAPP
- States, locals, and tribal QA Staff





Mimic the EPA!

- Use same approach as the federal TSA!
- Develop a TSA audit form based on your agency's quality system requirements
- Develop audit schedule
 - Recommend annual audits, at minimum
- Document findings in reports routed through chain-of-command





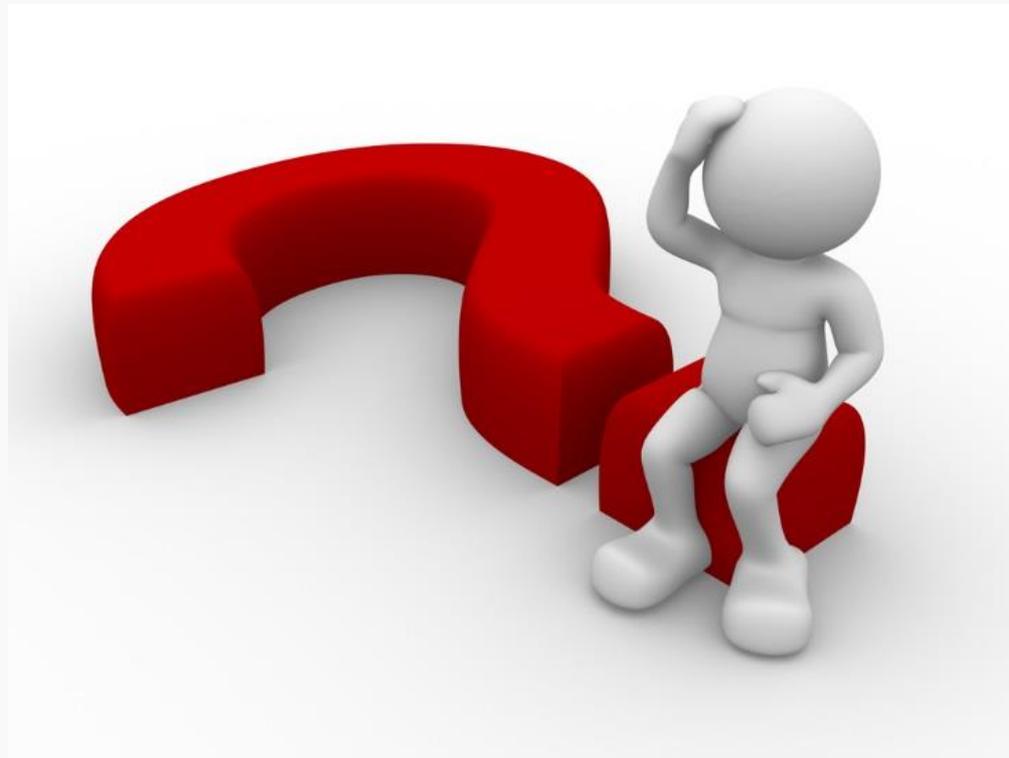
Internal TSA Benefits

- Illustrates areas where supplemental training may be beneficial
- Prevents data loss
- Improves overall data quality
- Enhances quality system
- Small issues won't become big issues!
- Significantly reduces EPA findings during the regulatory TSA!





Questions?



National Ambient Air Monitoring Conference August 2014