



ARB PM2.5 Filter Processing and Validation

A Lab and Field Perspective

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Common Goal

- We are in it together
- Change is hard
- Communication is **KEY**



Health

- Motivation
- What's in it for me?



Northern Laboratory Branch PM2.5 FRM, Coarse, and SASS Programs

- 46 Sites Total (FRM, Coarse, SASS)
 - BAAQMD Lab Support
 - ARB Research Division
- 6,000 samples processed per year
 - Pre- and Post- weights >12,000 per year

Lab Guiding Documents

- SOPs
- QAPPs
- Technical Bulletins
- EPA QA Handbook for Air Pollution Measurement Systems, Volume II
- EPA Quality Assurance Guidance Document 2.12

Critical Criteria

- EPA QA Handbook for Air Pollution Measurement Systems, Volume II
 - Validation Template (Lab and Field)
 - Critical Criteria
 - Operational Evaluations
 - Systematic Criteria

Lab Critical Criteria

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Filter Based Local Conditions			
<i>Post-sampling Weighing</i>	<i>all filters</i>	<i>≤10 days from sample end date if shipped at ambient temp, or ≤30 days if shipped below avg ambient (or 4° C or below for avg sampling temps < 4° C) from sample end date</i>	1, 2 and 3) 40 CFR Part 50 App L Sec 8.3.6 Sampled filters must be protected from exposure to temperatures above 25C from sample retrieval to conditioning 40 CFR part 50 Appendix L Sec 10.13. See technical note on holding time requirements at : https://www3.epa.gov/ttn/amtic/pmpolgud.html
<i>Filter Visual Defect Check (unexposed)</i>	<i>all filters</i>	<i>Correct type & size and for pinholes, particles or imperfections</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 10.2
<i>Filter Conditioning Environment</i>			
<i>Equilibration</i>	<i>all filters</i>	<i>24 hours minimum</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.2.5
<i>Temp. Range</i>	<i>all filters</i>	<i>24-hr mean 20.0-23.0° C</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.2.1
<i>Temp. Control</i>	<i>all filters</i>	<i>< 2.1° C SD* over 24 hr</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.2.2
<i>Humidity Range</i>	<i>all filters</i>	<i>24-hr mean 30.0% - 40.0% RH or Within +5.0 % sampling RH but > 20.0%RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.2.3
<i>Humidity Control</i>	<i>all filters</i>	<i>< 5.1 % SD* over 24 hr.</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.2.4
<i>Pre/post Sampling RH</i>	<i>all filters</i>	<i>difference in 24-hr means < + 5.1% RH</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.3.3
<i>Balance</i>	<i>all filters</i>	<i>located in filter conditioning environment</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 8.3.2
<i>Microbalance Auto-Calibration</i>	<i>Prior to each weighing session</i>	Manufacturer's specification	1) 40 CFR Part 50, App. L, Sec 8.1 2) 40 CFR Part 50, App. L, Sec 8.1 and Method 2.12 Sec. 10.6 3) NA

https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/PM2.5_Val_Template_4_27_16.pdf

Lab Critical Criteria

- 24 Hours Balance Room “In”
 - 20 – 23 degrees C
 - 30% - 40% Relative Humidity
- 24 Hours Filter Equilibration
- Filters weighed within 30 days
 - Ship filters below 4 degrees C
 - IF shipped *above* average ambient temp. samples must be weighed within 10 days.

Ideal Situation

Sample
0

Filter is Sampled

Sample
<7.4
Days

Filter is Retrieved within 7.4 Days

Sample
5 Days

Filter is Shipped to Lab in 5 Days

Filter Equilibrates 24 Hours

Sample
1 Day

Filter Weighed the next Day

Sample
13 Days
Old



Unfortunate Situation

Sample
0

Filter is Sampled

Sample
<7.4
Days

Filter is Retrieved within 7.4 Days

Sample
17 Days

Filter is Shipped to Lab in 17
Days
(UPS Delay)

Filter Equilibrates 72 Hours
(Balance Room "Out")

Sample
3 Days

Filter Weighed After Thanksgiving
weekend Holiday (4 more days)

Sample
31 Days
Old

INVALID

Is It Valid?

- What info do we have from the Field?
- Does it meet the Critical Criteria?
 - Balance Room Requirements
 - Holding time Requirements
- Is there filter damage?
 - Dent, cut, fingerprint, contamination, pinhole...



Statistics on Invalid Samples

- 12 Months
 - Cut/Dent/Torn/Damaged (60)
 - Pinhole(s) (32)
 - Contamination (20)

Statistics Continued

- 12 Months
 - Sample Duration <23 Hours OR >25 Hours (24)
 - Non-Midnight start time (24)
 - Retrieval >7.4 Days (14)
 - Samples not weighed within 30 Days (10)

~250 Invalid Samples Total

Solutions

- **Make-Ups (Except Daily sites)**
 - Before next scheduled run OR
 - Exactly one week after missed/invalid run
- **Send samples back to the lab ASAP**
- **Lab Communication**

Invalid Samples Impacts

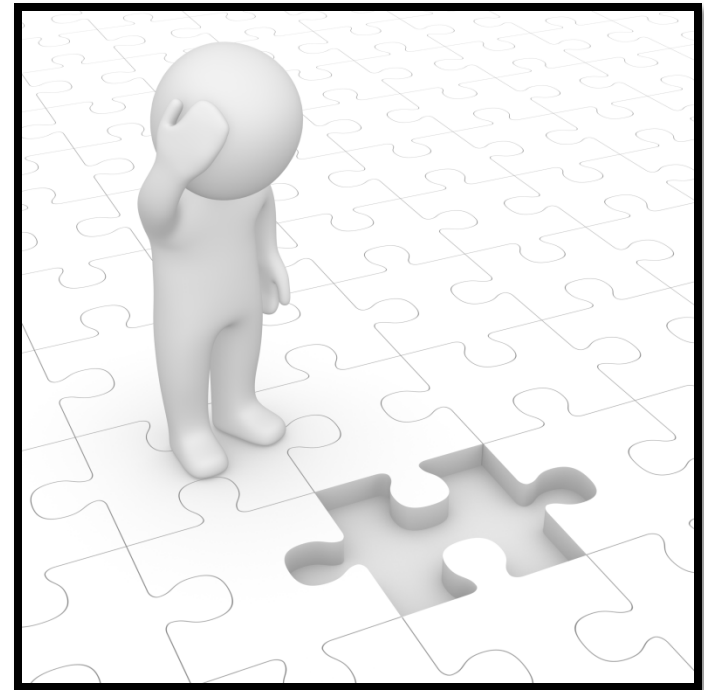
Federal Design Values

Meeting completeness criteria and required averages to reach attainment.



Sample Handling

- Chain-of-custody completeness.
 - Is it Valid?
 - Is it complete?
 - Does it make sense?
 - Are all the pieces there?



Take Out the Guesswork



- Emails
- Phone Calls
- Time
- Time
- Time

Sample Handling Continued

- Noting unusual conditions on the Chain-of-Custody (CoC)
 - Rain, wind
 - Fires, construction, fireworks
 - Leak checks and audits
 - Sampler issues
 - Power Outages

Sample Handling



- Submit all the pieces to the puzzle.



Together we can achieve more!

Positive Feedback

Synergy - the bonus that is achieved when things work together harmoniously.

-Mark Twain



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ARB - Field Staff Responsibilities

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Field Staff “Authorities”

- Invalidate samples based on field criteria before sending to lab
 - Lab staff will not invalidate field criteria
 - Document on Field Report/CoC
- Request Make-ups from Lab
 - Indicate on Field Report/CoC that sample is make-up
 - Know Make-up “Rules”

Field Guiding Documents

- SOPs
- Technical Bulletins
- EPA QA Handbook for Air Pollution Measurement Systems, Volume II

Document Properly

- Include appropriate information on the form
- Error on the side of including more information
- Write clearly. Blue or black ink only. No pencil. No white out. Strike out and initial changes.



Field Critical Criteria

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Filter Based Local Conditions			
Field Activities			
<i>Sampler/Monitor</i>	NA	<i>Meets requirements listed in FRM/FEM/ARM designation</i>	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
<i>Pre-sampling</i>	<i>all filters</i>	<i>< 30 days before sampling</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 8.3.5
<i>Sample Recovery</i>	<i>all filters</i>	<i>< 7 days 9 hours from sample end date</i>	1,2 and 3) 40 CFR Part 50, App. L 10.10
<i>Sampling Period (including multiple power failures)</i>	<i>all filters</i>	<i>1380-1500 minutes, or if value < 1380 and exceedance of NAAQS ^{1/} midnight to midnight local standard time</i>	1, 2 and 3) 40 CFR Part 50 App L Sec 3.3 and 40 CFR Part 50 App N section 1 for the midnight to midnight local standard time requirement See details if less than 1380 min sampled
<i>Sampling Instrument</i>			
<i>Average Flow Rate</i>	<i>every 24 hours of op</i>	<i>average within 5% of 16.67 liters/minute</i>	1, 2 and 3) Part 50 App L Sec 7.4.3.1
<i>Variability in Flow Rate</i>	<i>every 24 hours of op</i>	<i>CV < 2%</i>	1, 2 and 3) 40 CFR Part 50, App .L Sec 7.4.3.2
<i>One-point Flow Rate Verification</i>	<i>every 30 days</i>	<i>< ± 4.1% of transfer standard < ± 5.1% of flow rate design value</i>	1, 2 and 3) 40 CFR Part 50, App .L, Sec 9.2.5 and 7.4.3.1 and 40 CFR Part 58, Appendix A Sec 3.2.1
<i>Design Flow Rate Adjustment</i>	<i>After multi-point calibration or verification</i>	<i>< ± 2.1% of design flow rate</i>	1,2 and 3) 40 CFR Part 50, App. L, Sec 9.2.6
<i>Individual Flow Rates</i>	<i>every 24 hours of op</i>	<i>no flow rate excursions > +5% for > 5 min. ^{1/}</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 7.4.3.1
<i>Filter Temp Sensor</i>	<i>every 24 hours of op</i>	<i>no excursions of > 5° C lasting longer than 30 min ^{1/}</i>	1, 2 and 3) 40 CFR Part 50, App. L Sec 7.4.11.4
<i>External Leak Check</i>	<i>Before each flow rate verification/calibration and before and after PM_{2.5} separator maintenance</i>	<i>< 80.1 mL/min (see comment #1)</i>	1) 40 CFR Part 50 App L, Sec 7.4.6.1 2) 40 CFR Part 50 App L Sect 9.2.3 and Method 2-12 Section 7.4.3 3) 40 CFR Part 50, App. L, Sec 7.4.6.1
<i>Internal Leak Check</i>	<i>If failure of external leak check</i>	<i>< 80.1 mL/min</i>	1) 40 CFR Part 50, App. L, Sec 7.4.6.2 2) Method 2-12 7.4.4 3) 40 CFR Part 50, App. L, Sec 7.4.6.2

https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/PM2.5_Val_Template_4_27_16.pdf

Field Criteria - Holding Times

- Filters sampled more than 30 days from their pre-weight date – Invalid
- Samples left on sampler >7.4 days – Invalid
- Return the samples to the lab promptly

Field Criteria - Sample Period

- Non-midnight Start Times - Invalid
 - Midnight to Midnight - Valid
- Runs 24 Hours \pm 1 are valid
 - One exception for runs between 18 and 23 hours – may be valid. Run a make-up in this situation.

Field Criteria – Flow

- Average Flow Rate: within 5% of 16.67 liters/min - Valid
- Variability in Flow Rate: $CV < 2\%$ - Valid

Field Criteria – Damaged Filters

- Make sure the piston is in the correct position



Summary

- Use appropriate reference documentation
- Adhere to proper holding time requirements
- Make sure sample runs for the sampling duration
- Verify flow criteria met
- Be careful handling the filters and limit damage

Questions?

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