

Appendix D

Measurement Quality Objectives and Validation Templates

AMTIC Version

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Any changes to the templates since the publication of the May 2013 Handbook publication will be identified in **red font**

In June 1998, a workgroup was formed to develop a procedure that could be used by State and locals that would provide for a consistent validation of PM_{2.5} mass concentrations across the US. The workgroup included personnel from the monitoring organizations, EPA Regional Offices, and OAQPS who are involved with assuring the quality of PM_{2.5} mass and was headed by a State and local representative. The workgroup developed three tables of criteria where each table has a different degree of implication about the quality of the data. The criteria included on the tables are from 40 CFR Part 50 Appendices L and N, 40 CFR Part 58 Appendix A, Method 2.12, and a few criteria that were neither in CFR nor Method 2.12 but which the workgroup felt should be included. Upon completion and use of the table, it was decided that a “validation template” should be developed for all the criteria pollutants.

One of the tables has the criteria that the workgroup felt *must* be met to ensure the quality of the data. An example criterion for PM_{2.5} is that the average flow rate for the sampling period must be maintained to within 5% of 16.67 liters per minute. The second table has the criteria that indicate that there *might* be a problem with the quality of the data and further investigation is warranted before making a determination about the validity of the sample or samples. An example criterion is that the field filter blanks should not change weight by more than 30 micrograms between weighings. The third table has criteria that indicate a potentially systematic problem with the environmental data collection activity. Such systematic problems may impact the ability to make decisions with the data. An example criterion is that at least 75% of the scheduled samples for each quarter should be successfully collected and validated.

To determine the appropriate table for each criterion, the members of the workgroup considered how significantly the criterion impacted the resulting concentration. This was based on experience from workgroup members, experience from non-workgroup members, and feasibility of implementing the criterion.

Criteria that were deemed critical to maintaining the integrity of a sample or group of samples were placed on the first table. Observations that do not meet each and every criterion on the **Critical Criteria Table** should be invalidated unless there are compelling reason and justification for not doing so. The sample or group of samples for which one or more of these criteria are not met is invalid until proven otherwise. The cause of not operating in the acceptable range for each of the violated criteria must be investigated and minimized to reduce the likelihood that additional samples will be invalidated.

Criteria that are important for maintaining and evaluating the quality of the data collection system are included on the second table, the **Operational Evaluations Table**. Violation of a criterion or a number of criteria may be cause for invalidation. The decision maker should consider other quality control information that may or may not indicate the data are acceptable for the parameter being controlled. Therefore, the sample or group of samples for which one or

more of these criteria are not met is suspect unless other quality control information demonstrates otherwise. The reason for not meeting the criteria **MUST** be investigated, mitigated or justified.

Finally, those 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 are included on the third table, the **Systematic Issues Table**. For example, the data quality objectives are included in this table. If the data quality objectives are not met, this does not invalidate any of the samples but it may impact the error rate associated with the attainment/non-attainment decision.

Please note the designation Operational or Systematic do not imply that these quality control checks need not be performed. If an operational or systematic quality control check that is required by regulation is not performed that can be a basis for invalidation of all associated data.

Following are the tables for all the criteria pollutants. For each criterion, the tables include: (1) the requirement (2) the frequency with which compliance is to be evaluated, (3) acceptance criteria, and (4) information where the requirement can be found or additional guidance on the requirement.

The validation templates have been developed based on the current state of knowledge. The templates should evolve as new information is discovered about the impact of the various criteria on the error in the resulting mass estimate or concentration. Due to the potential misuse of invalid data, data that are invalidated will not be uploaded to AQS but should be retained on the monitoring organizations local database. This data will be invaluable to the evolution of the validation template.

Use of Bold Italics Font to Identify CFR Requirements.

The criteria listed in the validation templates are either requirements that can be found in the Code of Federal Regulations, guidance found in a variety of guidance documents, or recommendations by the QA Workgroup or EPA. Any time a CFR requirement is identified in the Requirement, Frequency or Acceptance Criteria column it will be identified by ***bold and italics*** font. The Information/Action column will provide the appropriate references for CFR or guidance documents.

Hyperlink References

Where requirements or guidance documents are found on the web, a hyperlink is created which will lead the user to the closest URL address. Any links to CFR are directed to the electronic CFR document (e-CFR) which is the most up-to-date. E-CFR will not get you to an individual section. Therefore e-CFR is only hyperlinked once on each page.

PM₁₀ Note of Caution

The validation templates for PM₁₀ get complicated because PM₁₀ is required to be reported at standard temperature and pressure (STP) for comparison to the NAAQS (and follow 40 CFR Part 50 App J) and at local conditions if using it to monitor for PM_{10-2.5} (and follow 40 CFR Part 50 App O). Moreover, PM₁₀ can be measured with filter-based sampling techniques as well as with automated methods. The validation templates developed for PM₁₀ try to accommodate these differences, but monitoring organizations are cautioned to review the operations manual for the monitors/samplers they use and augment the validation template with QC information specific to their EPA reference or equivalent method designation and instrument.

<http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf>

Ozone Validation Template

1) Requirement (O ₃)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
<i>One Point QC Check Single analyzer</i>	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 ≤ ± 3.0 ppb (24 hr) ≤ ± 5.0 ppb (>24hr-14 day) 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 7.2.2 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 7.2.2
Shelter Temperature Device Check	1/6 mo	± 2° C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
<i>Annual Performance Evaluation Single analyzer</i>	<i>Every site 1/year within period of monitor operation, 25 % of sites quarterly</i>	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
<i>Federal Audits (NPAP)</i>	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 1.5 ppb difference all other levels percent difference ± 10%	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
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 range 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
<i>Zero Air/Zero Air Check</i>	1/year	Concentrations below LDL	1) 40 CFR Part 50 App D Section 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			
<i>Certification/recertification to Standard Reference Photometer (Level 1)</i>	1/year	single point difference ≤ ± 3%	1) 40 CFR Part 50 App D Section 5.4 2 and 3) Transfer Standard Guidance EPA-454/B-10-001

1) Requirement (O ₃)	2) Frequency	3) Acceptance Criteria	Information /Action
			Level 2 standard (formerly called primary standard) usually transported to EPA Regions SRP for comparison
Level 2 and Greater Transfer Standard Precision	1/year	Standard Deviation less than 0.005 ppm or 3% whichever is greater	1) 40 CFR Part 50 Appendix D Sec 3.1 2) Recommendation, part of reverification 3) 40 CFR Part 50 Appendix D Sec 3.1
(if recertified via a transfer standard)	1/year	Regression slopes = 1.00 ± 0.03 and two intercepts are 0 ± 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Ozone Transfer standard (Level 3 and greater)			
Qualification	Upon receipt of transfer standard	$\pm 4\%$ or ± 4 ppb (whichever greater)	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Certification	After qualification and upon receipt/adjustment/repair	RSD of six slopes $\leq 3.7\%$ Std. Dev. of 6 intercepts 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 1
Recertification to higher level standard	Beginning and end of O ₃ season or 1/6 months whichever less	New slope = ± 0.05 of previous and RSD of six slopes $\leq 3.7\%$ Std. Dev. of 6 intercepts 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails
Detection (FEM/FRMs)			
Noise	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration or 1/year	≤ 0.005 ppm	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) NA 3) 40 CFR Part 53.20 Table B-1
Lower detectable level	1/year	0.01 ppm	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA-OZONE			
Sampler/Monitor/ Transfer and Calibration Standard	NA	Meets requirements listed in FRM/FEM designation	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Standard Reporting Units	All data	ppm (final units in AQS)	1, 2 and 3) 40 CFR Part 50 App I sec 2.1.1
Rounding convention for data reported to AQS	All data	3 places after decimal with digits to right truncated	1, 2 and 3) 40 CFR Part 50 App I sec 2.1.1
Completeness (seasonal)	3-Year Comparison	$\geq 90\%$ (avg) daily max available in ozone season with min of 75% in any one year.	1) 40 CFR Part 50 App I 2) 40 CFR Part 50 App I Section 2.3 3) 40 CFR Part 50 App I Section 2.3 (b)
	8- hour average	$\geq 75\%$ of hourly averages for the 8-hour	1) 40 CFR Part 50 App I 2 and 3) 40 CFR Part 50 App I Section 2.1.1
	Valid Daily Max	$\geq 75\%$ of the 24, 8 hour averages (18 of 24 8-hour averages)	1) 40 CFR Part 50 App I 2) 40 CFR Part 50 App I Section 2.1.2 3) 40 CFR Part 50 App I Section 2.1.2 (b)
Sample Residence Time Verification	1/year	< 20 seconds	1) 40 CFR Part 58 App E, section 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, section 9 (c)
Sample Probe, Inlet, Sampling	All sites	Borosilicate glass (e.g., Pyrex®) or Teflon®	1) 40 CFR Part 58 App E, section sec 9 (a)

1) Requirement (O ₃)	2) Frequency	3) Acceptance Criteria	Information /Action
<i>train</i>			2) Recommendation 3) 40 CFR Part 58 App E, section sec 9 (a) FEP and PFA have been accepted as a equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
<i>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-6 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-6
EPA Standard Ozone Reference Photometer (SRP) Recertification (Level 1)	1/year	Regression slope = 1.00 ± 0.01 and intercept < 3 ppb	1,2 and 3) Transfer Standard Guidance EPA-454/B-10-001 This is usually at a Regional Office and is compared against the traveling SRP
<i>Precision(using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	90% CL CV \leq 7%	1) 40 CFR Part 58 App A 2.3.1.2 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.2
Bias (using 1-point QC checks)	<i>Calculated annually and as appropriate for design value estimates</i>	95% CL \leq \pm 7%	1) 40 CFR Part 58 App A 2.3.1.2 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.3
Annual PE Primary QA Organization (PQAO) Evaluation	1/year	95% of audit percent differences fall within the one point QC check 95% probability intervals at PQAO level of aggregation	1) 40 CFR Part 58 App A Section 3.2.2 2) Recommendation 3) 40 CFR Part 58 App A sec 4.1.4 & 4.1.5

CO Validation Template

1) Requirement (CO)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-CO			
<i>One Point QC Check Single analyzer</i>	1/2 weeks	$\leq \pm 10\%$ (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. QC Check Conc range 1 - 10 ppm relative to routine concentrations
Zero/span check	1/2 weeks	Zero drift $\leq \pm 0.4$ ppm (24 hr) $\leq \pm 0.6$ ppm (>24hr-14 day) Span drift $\leq \pm 10\%$	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation
OPERATIONAL CRITERIA-CO			
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 7.2.2 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)	$\leq \pm 2^\circ$ C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	1/6 mo	$\pm 2^\circ$ C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
<i>Annual Performance Evaluation Single Analyzer</i>	<i>Every site 1/year 25 % of sites quarterly</i>	Percent difference of audit levels 3-10 $\leq \pm 15\%$ Audit levels 1&2 ± 0.03 ppm difference or $\pm 15\%$	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
<i>Federal Audits (NPAP)</i>	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 0.03 ppm difference all other levels percent difference $\pm 15\%$	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
<i>Verification/Calibration</i>	Upon receipt/adjustment/repair/installation/moving 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed daily	All points within $\pm 2\%$ of calibration range of best-fit straight line	1) 40 CFR Part 50 Appendix C Section 4 2 and 3) Recommendation See details about CO2 sensitive instruments Multi-point calibration (0 and 4 upscale points)
<i>Gaseous Standards</i>	All gas cylinders	NIST Traceable (e.g., EPA Protocol Gas)	1) 40 CFR Part 50 Appendix C Section 4.3.1 2) NA Green book 3) 40 CFR Part 50 Appendix C Section 4.3.1 See details about CO2 sensitive instruments Gas producer used must participate in EPA Ambient Air Protocol Gas Verification Program 40 CFR Part 58 App A sec 2.6.1
<i>Zero Air/Zero Air Check</i>	1/year	< 0.1 ppm CO	1) 40 CFR Part 50 App C Section 4.3.2

1) Requirement (CO)	2) Frequency	3) Acceptance Criteria	Information /Action
			2) Recommendation 3) 40 CFR Part 50 App C Section 4.3.2
Gas Dilution Systems	1/year or after failure of 1 point QC check or performance evaluation	Accuracy $\pm 2\%$	1,2 and 3) Recommendation based on SO2 requirement in 40 CFR Part 50 App A-1 Sec 4.1.2
Detection (FEM/FRMs)			
<i>Noise</i>	1/year	<i>0.2 ppm (standard range) 0.1 ppm (lower range)</i>	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info obtained from LDL 3) 40 CFR Part 53.20 Table B-1
<i>Lower detectable level</i>	1/year	<i>0.4 ppm(standard range) 0.2 ppm (lower range)</i>	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA-CO			
<i>Sampler/Monitor</i>	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
<i>Standard Reporting Units</i>	<i>All data</i>	<i>ppm (final units in AQS)</i>	1, 2 and 3)) 40 CFR Part 50.8 (a)
<i>Rounding convention for data reported to AQS</i>	<i>All data</i>	<i>1 decimal place</i>	1, 2 and 3) 40 CFR Part 50.8 (d) (for averaging values for comparison to NAAQS not for reporting individual hourly values.)
<i>Completeness</i>	<i>8-hour standard</i>	<i>75% of hourly averages for the 8-hour period</i>	1) 40 CFR Part 50.8(c) 2) 40 CFR Part 50.8(a-2) 3) 40 CFR Part 50.8(c)
Sample Residence Time Verification	1/year	< 20 seconds	1,2, and 3) Recommendation. CO not a reactive gas but suggest following same methods other gaseous criteria pollutants.
Sample Probe, Inlet, Sampling train	All Sites	Borosilicate glass (e.g., Pyrex®) or Teflon®	1,2, and 3) Recommendation. CO not a reactive gas but suggest following same methods other gaseous criteria pollutants. FEP and PFA have been accepted as a equivalent material to Teflon. Replacement/cleaning is suggested as 1/year and more frequent if pollutant load dictate.
<i>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-6 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-6
<i>Precision(using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>90% CL CV $\leq 10\%$</i>	1) 40 CFR part 58 App A sec 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.2
<i>Bias (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>95% CL $\leq \pm 10\%$</i>	1) 40 CFR Part 58 App A sec 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.3
<i>Annual PE Primary QA Organization (PQAO) Evaluation</i>	1/year	<i>95% of audit percent differences fall within the one point QC check 95% probability intervals at PQAO level of aggregation</i>	1) 40 CFR Part 58 App A Section 3.2.2 2) Recommendation 3) 40 CFR Part 58 App A sec 4.1.4 & 4.1.5

NO₂ , NO_x, NO Validation Template

1) Requirement (NO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- NO₂			
<i>One Point QC Check Single analyzer</i>	<i>1/ 2 weeks</i>	$\leq \pm 15\%$ (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 2.3.1.5 QC Check Conc range 0.01 - 0.10 ppm Relative to routine concentrations
Zero/span check	1/ 2 weeks	Zero drift $\leq \pm 3.0$ ppb (24 hr) $\leq \pm 5.0$ ppb (>24hr-14 day) Span drift $\leq \pm 10\%$	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation and related to DQO
<i>Converter Efficiency</i>	During multi-point calibrations, span and audit 1/ 2 weeks	$(\geq 96\%)$ 96% – 104%	1) 40 CFR Part 50 App F Section 1.5.10 and 2.4.10 2) Recommendation 3) 40 CFR Part 50 App F Section 1.5.10 and 2.4.10 Regulation states $\geq 96\%$, 96 – 104% is a recommendation.
OPERATIONAL CRITERIA- NO₂			
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 7.2.2 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)	$\leq \pm 2^\circ$ C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Shelter Temperature Device Check	1/6 mo	$\pm 2^\circ$ C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
<i>Annual Performance Evaluation Single Analyzer</i>	<i>Every site 1/year 25 % of sites quarterly</i>	Percent difference of audit levels 3-10 $\leq \pm 15\%$ Audit levels 1&2 ± 1.5 ppb difference or $\pm 15\%$	1) 40 CFR Part 58 App A sec 3.2.2 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
<i>Federal Audits (NPAP)</i>	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 1.5 ppb difference all other levels percent difference $\pm 15\%$	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
<i>Verification/Calibration</i>	Upon receipt/adjustment/repair/ installation/moving 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed	Instrument residence time ≤ 2 min Dynamic parameter ≥ 2.75 ppm-min All points within $\pm 2\%$ of calibration range of best-fit straight line	1) 40 CFR Part 50 App F 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points)

1) Requirement (NO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
	daily		
<i>Gaseous Standards</i>	All gas cylinders	<u>NIST Traceable</u> (e.g., EPA Protocol Gas) 50-100 ppm of NO in Nitrogen with < 1 ppm NO ₂	1) 40 CFR Part 50 App F Section 1.3.1 2) NA <u>Green book</u> 3) 40 CFR Part 50 App F Section 1.3.1 Gas producer used must participate in EPA <u>Ambient Air Protocol Gas Verification Program</u> 40 CFR Part 58 App A sec 2.6.1
<i>Zero Air/ Zero Air Check</i>	1/year	Concentrations below LDL	1) <u>40 CFR Part 50 App F</u> Section 1.3.2 2 and 3) Recommendation
Gas Dilution Systems	1/year or after failure of 1 point QC check or performance evaluation	Accuracy ± 2 %	1,2 and 3) Recommendation based on SO ₂ requirement in 40 CFR Part 50 App A-1 Sec 4.1.2
Detection (FEM/FRMs)			
<i>Noise</i>	NA	0.005 ppm	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) NA 3) 40 CFR Part 53.20 Table B-1
<i>Lower detectable level</i>	1/year	0.01 ppm	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA- NO₂			
<i>Sampler/Monitor</i>	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & <u>FRM/FEM method list</u>
<i>Standard Reporting Units</i>	<i>All data</i>	<i>ppb (final units in AQS)</i>	1,2 and 3) 40 CFR Part 50 App S Sec 2 (c)
<i>Rounding convention for data reported to AQS</i>	<i>All data</i>	<i>1 place after decimal with digits to right truncated</i>	1, 2 and 3) 40 CFR Part 50 App S Sec 4.2 (a)
<i>Completeness</i>	<i>Annual Standard</i>	<i>≥ 75% hours in year</i>	1) 40 CFR Part 50 App S sec 3.1(b) 2) 40 CFR Part 50 App S sec 3.1(a) 3) 40 CFR Part 50 App S sec 3.1(b)
	<i>1-hour standard</i>	<i>1) 3 consecutive calendars years of complete data 2) 4 quarters complete in each year 3) ≥75% sampling days in quarter 4) ≥ 75% of hours in a day</i>	1) 40 CFR Part 50 App S sec 3.2(b) 2) 40 CFR Part 50 App S sec 3.2(a) 3) 40 CFR Part 50 App S sec 3.2(b) More details in 40 CFR Part 50 App S
<i>Sample Residence Time Verification</i>	1/year	< 20 seconds	1) 40 CFR Part 58 App E, section 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, section 9 (c)
<i>Sample Probe, Inlet, Sampling train</i>	<i>All sites</i>	<i>Borosilicate glass (e.g., Pyrex®) or Teflon®</i>	1, 2 and 3) 40 CFR Part 58 App E sec 9 (a) FEP and PFA have been accepted as equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant

1) Requirement (NO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
			load or contamination dictate
Siting	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-6 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-6
<i>Precision(using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>90% CL CV ≤ 15%</i>	1) 40 CFR Part 58 App A sec 2.3.1.5 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.2
<i>Bias (using 1-point QC checks)</i>	<i>Calculated annually and as appropriate for design value estimates</i>	<i>95% CL ≤ ± 15%</i>	1) 40 CFR Part 58 App A sec 2.3.1.5 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.3
<i>Annual PE Primary QA Organization (PQAO) Evaluation</i>	1/year	<i>95% of audit percent differences fall within the one point QC check 95% probability intervals at PQAO level of aggregation</i>	1) 40 CFR Part 58 App A Section 3.2.2 2) Recommendation 3) 40 CFR Part 58 App A sec 4.1.4 & 4.1.5

SO₂ Validation Template

1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA- SO₂			
<i>One Point QC Check Single analyzer</i>	<i>1/2 weeks</i>	≤ ±10% (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 ≤ ± 3.0 ppb (24 hr) ≤ ± 5.0 ppb (>24hr-14 day) Span drift ≤ ± 10 %	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA- SO₂			
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 7.2.2 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 7.2.2
Shelter Temperature Device Check	1/6 mo	± 2° C of standard	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
<i>Annual Performance Evaluation Single Analyzer</i>	<i>Every site 1/year 25 % of sites quarterly</i>	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
<i>Federal Audits (NPAP)</i>	1/year at selected sites 20% of sites audited	Audit levels 1&2 ± 1.5 ppb difference all other levels percent difference ± 15%	1) 40 CFR Part 58 App A sec 2.4 2) NPAP adequacy requirements on AMTIC 3) NPAP QAPP/SOP
<i>Verification/Calibration</i>	Upon receipt/adjustment/repair/ installation/moving 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed daily	All points within ± 2 % of calibration range of best-fit straight line	1) 40 CFR Part 50 App A-1 Section 4 2 and 3) Recommendation Multi-point calibration (0 and 4 upscale points)
<i>Gaseous Standards</i>	<i>All gas cylinders</i>	<i><u>NIST Traceable</u></i> <i>(e.g., EPA Protocol Gas)</i>	1) 40 CFR Part 50 App A-1 Section 4.1.6.1 2) NA Green book 3) 40 CFR Part 50 App F Section 1.3.1 Producers must participate in Ambient Air Protocol Gas Verification Program 40 CFR Part 58 App A sec 2.6.1
<i>Zero Air/ Zero Air Check</i>	1/year	Concentrations below LDL	1) 40 CFR Part 50 App A-1 Section 4.1.6.2

1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
		< 0.1 ppm aromatic hydrocarbons	2) Recommendation 3) Recommendation and 40 CFR Part 50 App A-1 Section 4.1.6.2
Gas Dilution Systems	1/year or after failure of 1 point QC check or performance evaluation	<i>Accuracy ± 2 %</i>	1) 40 CFR Part 50 App A-1sec 4.1.2 2) Recommendation 3) 40 CFR Part 50 App A-1 sec 4.1.2
Detection (FEM/FRMs)			
Noise	NA	<i>0.001 ppm (standard range) 0.0005 ppm (lower range)</i>	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) NA 3)) 40 CFR Part 53.20 Table B-1
Lower detectable level	1/year	<i>0.002 ppm (standard range) 0.001 ppm (lower range)</i>	1) 40 CFR Part 53.23 (c) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA- SO₂			
Sampler/Monitor	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Standard Reporting Units	<i>All data</i>	<i>ppb (final units in AQS)</i>	1, 2 and 3) 40 CFR Part 50 App T Sec 2 (c)
Rounding convention for data reported to AQS	<i>All data</i>	<i>1 place after decimal with digits to right truncated</i>	1, 2 and 3) 40 CFR Part 50 App T Sec 2 (c)
Completeness	<i>1 hour standard</i>	<i>Hour – 75% of hour Day- 75% hourly Conc Quarter- 75% complete days Years- 4 complete quarters 5-min value reported only for valid hours</i>	1, 2 and 3) 40 CFR Part 50 App T Section 3 (b), (c) More details in CFR on acceptable completeness. 5-min values or 5-min max value only reported for the valid portion of the hour reported. If the hour is incomplete no 5-min or 5-min max reported.
Sample Residence Time Verification	1/year	< 20 seconds	1) 40 CFR Part 58 App E, section 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, section 9 (c)
Sample Probe, Inlet, Sampling train	<i>All sites</i>	<i>Borosilicate glass (e.g., Pyrex®) or Teflon®</i>	1, 2 and 3) 40 CFR Part 58 App E sec 9 (a) FEP and PFA have been accepted as equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Precision(using 1-point QC checks)	<i>Calculated annually and as appropriate for design value estimates</i>	<i>90% CL CV ≤ 10%</i>	1) 40 CFR Part 58 App A sec 2.3.1.6 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.2
Bias (using 1-point QC checks)	<i>Calculated annually and as appropriate for design value estimates</i>	<i>95% CL ≤ ± 10%</i>	1) 40 CFR Part 58 App A sec 2.3.1.6 & 3.2.1 2) 40 CFR Part 58 App A sec 4 (b) 3) 40 CFR Part 58 App A sec 4.1.3
Annual PE Primary QA Organization (PQAO)	1/year	<i>95% of audit percent differences fall within the one point QC check 95% probability intervals</i>	1) 40 CFR Part 58 App A Section 3.2.2 2) Recommendation

1) Requirement (SO ₂)	2) Frequency	3) Acceptance Criteria	Information /Action
<i>Evaluation</i>		<i>at PQAO level of aggregation</i>	3) 40 CFR Part 58 App A sec 4.1.4 and 4.1.5

PM_{2.5} Filter Based Local Conditions Validation Template

1) Criteria (PM _{2.5} LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Filter Based Local Conditions			
Field Activities			
Filter Holding Times			
<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 Sec 10.10
<i>Sampling Period (including multiple power failures)</i>	<i>all filters</i>	<i>1380-1500 minutes, or value if < 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 See details if less than 1380 min sampled
Sampling Instrument			
<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>1/mo</i>	<i>± 4% of transfer standard ± 5% 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 3.2.3 & 3.3.2
Laboratory Activities			
<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
<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
Filter Conditioning Environment			
<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 20-23° 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° 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% - 40% RH or ≤5% sampling RH but > 20%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% 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% 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
OPERATIONAL EVALUATIONS TABLE PM_{2.5} Filter Based Local Conditions			
Field Activities			
Sampling Instrument			
<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
Routine Verifications			

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
<i>External Leak Check</i>	every 5 sampling events	< 80 mL/min (see comment #1)	1) 40 CFR Part 50 App L , Sec 7.4.6.1 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.1
<i>Internal Leak Check</i>	every 5 sampling events	< 80 mL/min	1) 40 CFR Part 50, App.L, Sec 7.4.6.2 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.2
<i>One-point Temp Verification</i>	1/mo	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
<i>Pressure Verification</i>	1/mo	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
<i>Temperature multi-point Verification/Calibration</i>	on installation, then 1/yr	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
<i>Pressure Verification/Calibration</i>	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or</i> 1/yr	± 4% of transfer standard	1) 40 CFR Part 50, App.L, Sec 9.2. 2) 40 CFR Part 50, App.L, Sec 9.1.3, Method 2.12 Table 6-1 3) 40 CFR Part 50, App.L, Sec 9.2.5
<i>Design Flow Rate Adjustment</i>	<i>at one-point or multi-point verification/calibration</i>	± 2% of design flow rate	1,2 and 3) 40 CFR Part 50, App.L, Sec 9.2.6
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1,2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites by method designation</i>	CV ≤ 10% of samples > 3 µg/m ³	1) and 2) Part 58 App A Sec 3.2.5 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.1
Accuracy			
Temperature Audit	1/yr	± 2°C	1, 2 and 3) Method 2.12 Sec. 10.2.2 & Table 3-1
Pressure Audit	1/yr	±10 mm Hg	1, 2 and 3) Method 2.12 Sec. 10.2.3 & Table 3-1
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	± 4% of audit standard ± 5% of design flow rate	1 and 2) Part 58, App A, Sec 3.3.3 3) Method 2.12 Sec. 10.2.1 & Table 10-1
Monitor Maintenance			
Impactor (WINs)	every 5 sampling events	cleaned/changed	1, 2,and 3) Method 2.12 Sec 8.3.1
Very Sharp Cut Cyclone	every 30 days	cleaned/changed	1,2 and 3) Recommendation
Inlet/downtube Cleaning	every 15 sampling events	cleaned	1,2 and 3) Method 2.12 Sec 9.3
Filter Chamber Cleaning	1/mo	cleaned	1, 2 and 3) Method 2.12 Sec 9.3 and 9.4.1

1) Criteria (PM _{2.5} LC)	2) Frequency	3) Acceptable Range	Information /Action
Circulating Fan Filter Cleaning	1/mo	cleaned/changed	1, 2 and 3) Method 2.12 Sec 9.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	less than 15 µg change between weighings	1, 2, 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor.
Exposure Lot Blanks	3 filters per lot	less than 15 µg change between weighings	1,2 and 3) Method 2.12 Sec. 7.7 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1,2 and 3) Method 2.12 Sec. 7.10
Filter Holding Times			
<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
Lab QC Checks			
<i>Field Filter Blank</i>	10% or 1 per weighing session	± 30 µg change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.1 2 and 3) Method 2.12 Sec. 7.7
<i>Lab Filter Blank</i>	10% or 1 per weighing session	± 15 µg change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.2 2 and 3) Method 2.12 Sec. 7.7
Balance Check (working standards)	beginning, 10th sample, end	≤3 ±µg	1,2 and 3) Method 2.12 Sec. 7.9
Duplicate Filter Weighing	1 per weighing session	± 15 µg change between weighings	1,2 and 3) Method 2.12 Sec 7.11
Microbalance Audit	1/yr	± 0.050 mg or manufacturers specs, whichever is tighter	1,2 and 3) Method 2.12 Sec. 10.2.6
Verification/Calibration			
Lab Temperature	1/6 months	± 2°C	1) Method 2.12 Table 3-2 2) Recommendation. Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2
Lab Humidity	1/6 months	± 2%	1) Method 2.12 Table 3-2 2) Recommendation Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2
<i>Microbalance Calibration</i>	<i>At installation and prior to each weighing session</i> 1/yr	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. 7.2 3) NA
Calibration & Check Standards -			
Working Mass Stds. (compare to primary standards) Primary standards	1/3 mo. 1/yr	0.025 mg 0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3 and 7.3
SYSTEMATIC CRITERIA -PM_{2.5} Filter Based Local Conditions			
<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

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
<i>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
<i>Data Completeness</i>	<i>Annual Standard</i>	<i>> 75% scheduled sampling days in each quarter</i>	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
	<i>24- Hour Standard</i>	<i>≥ 75% scheduled sampling days in each quarter</i>	1, 2 and 3) 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
<i>Reporting Units</i>	<i>all filters</i>	<i>µg/m³ at ambient temp/pressure (PM_{2.5})</i>	1, 2 and 3) 40 CFR Part 50 App N Sec 3.0 (b)
<i>Rounding convention for data reported to AQS</i>	<i>all filters</i>	<i>to one decimal place, with additional digits to the right being truncated</i>	1, 2 and 3) 40 CFR Part 50 App N Sec 3.0 (b)
<i>Annual 3-yr average</i>	<i>all concentrations</i>	<i>nearest 0.1 µg/m³ (≥ 0.05 round up)</i>	1,2 and 3) 40 CFR Part 50, App. N Sec 3 and 4 Rounding convention for data reported to AQS is a recommendation
<i>24-hour, 3-year average</i>	<i>all concentrations</i>	<i>nearest 1 µg/m³ (≥ 0.5 round up)</i>	1,2 and 3) 40 CFR Part 50, App. N Sec 3 and 4 Rounding convention for data reported to AQS is a recommendation
Detection Limit			
<i>Lower DL</i>	<i>all filters</i>	<i>≤ 2 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.1
<i>Upper Conc. Limit</i>	<i>all filters</i>	<i>≥ 200 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.2
Precision			
Single analyzer (collocated monitors)	1/3 mo.	Coefficient of variation (CV) ≤ 10% for values > 3 µg/m ³	1,2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV ≤ 10% for values > 3 µg/m³</i>	1,2 and 3) 40 CFR Part 58, App A, Sec 4.3.1 and 2.3.1.1
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites</i> <i>8 audits for PQAOs with > 5 sites</i>	<i>±10% for values > 3 µg/m³</i>	1,2 and 3) 40 CFR Part 58, App A, Sec 3.2.7, 4.3.2 and 2.3.1.1
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	1/yr	<i>± 2% of NIST Traceable Std.</i>	1) 40 CFR Part 50, App.L Sec 9.1 & 9.2 2) Method 2-12 Section 6.3.3 and Table 3-1 3) 40 CFR Part 50, App.L Sec 9.1 & 9.2
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Clock/timer Verification	1/mo	<i>1 min/mo</i>	1and 2) Method 2.12 Table 3-1 3) 40 CFR Part 50, App.L Sec 7.4.12
Laboratory Activities			
<i>Microbalance Readability</i>	<i>at purchase</i>	<i>1 µg</i>	1, 2 and 3) 40 CFR Part 50, App.L Sec 8.1

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
Microbalance Repeatability	1/yr	1 µg	1) Method 2.12 Sec 4.3.6 2) Recommendation 3) Method 2.12 Sec 4.3.6
Primary Mass. Verification/Calibration Standards Recertifications	1/yr	0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3.7 & Table 3-2
Comment #1			
The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

1/ value must be flagged SD * = standard deviation CV= coefficient of variation

Continuous PM2.5 Local Conditions Validation Template

NOTE: There may be a number of continuous monitors that may be designated as an FEM or an ARM. These monitors may have different measurement or sampling attributes that cannot be identified in this validation template. Monitoring organizations should review specific instrument operating manuals to augment this validation template as necessary. In general, 40 CFR Part 58 App A and 40 CFR Part 50 App L requirements apply to Continuous PM2.5

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM_{2.5} Continuous, Local Conditions			
<i>Sampling Period 24 hour estimate</i>	<i>every sample period</i>	$\geq 75\%$ (18) of hourly averages	1,2and 3) 40 CFR Part 50 App N Sec 3 (c) See additional details for sample periods less than 18 hours.
Hourly estimates	Every hour	Instrument dependent	See operators manual
Sampling Instrument			
<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>	$CV < 2\%$	1, 2 and 3) 40 CFR Part 50, App.L Sec 7.4.3.2
<i>One-point Flow Rate Verification</i>	<i>1/mo</i>	$\pm 4\%$ of transfer standard $\pm 5\%$ of flow rate design value	1, 2 and 3) 40 CFR Part 50, App.L, Sec 9.2.5, 40 CFR Part 58, Appendix A Sec 3.2.3 & 3.3.2
BAM Specific Critical Criteria			
Reference Membrane Span Foil Verification (BAM)	Hourly	$\pm 4\%$ of ABS Value	1,2 and 3) BAM 1020 Operation Manual
OPERATIONAL CRITERIA- PM_{2.5} Continuous, Local Conditions			
Annual Multi-point Verifications/Calibrations			
<i>Leak Check</i>	every 30 days	< 1.0 lpm BAM (Not Thermo BAMS) ± 0.15 lpm TEOM	1) 40 CFR Part 50 App L, Sec 7.4.6.1 2) Recommendation 3) BAM SOP Sec 10.1.2 TEOM SOP Sec 10.1.6 Thermo BAM leak check should not be attempted. Foils could be ruptured.
<i>Temperature multi-point Verification/Calibration</i>	on installation, then 1/yr	$\pm 2^\circ\text{C}$	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
<i>One-point Temp Verification</i>	1/mo	$\pm 2^\circ\text{C}$	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
<i>Pressure Verification/Calibration</i>	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 BP verified against independent standard verified against a lab primary standard that is certified NIST traceable 1/year

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or</i> 1/yr	$\pm 4\%$ of transfer standard	1) 40 CFR Part 50, App.L, Sec 9.2. 2) 40 CFR Part 50, App.L, Sec 9.1.3, Method 2.12 Table 6-1 3) 40 CFR Part 50, App.L, Sec 9.2.5
<i>Design Flow Rate Adjustment</i>	<i>at one-point or multi-point verification/calibration</i>	$\pm 2\%$ of design flow rate	1,2 and 3) 40 CFR Part 50, App.L, Sec 9.2.6
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites by method designation</i>	CV $\leq 10\%$ of samples $> 3 \mu\text{g}/\text{m}^3$	1) and 2) Part 58 App A Sec 3.2.5 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.3
Accuracy			
Temperature Audit	1/yr	$\pm 2^\circ\text{C}$	1, 2 and 3) Method 2.12 Sec. 10.2.2 & Table 3-1
Pressure Audit	1/yr	± 10 mm Hg	1, 2 and 3) Method 2.12 Sec. 10.2.3 & Table 3-1
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	$\pm 4\%$ of audit standard $\pm 5\%$ of design flow rate	1 and 2) Part 58, App A, Sec 3.3.3 3) Method 2.12 Sec. 10.2.1 & Table 10-1
Shelter Temperature			
Temperature range	Daily (hourly values)	20 to 30° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	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
Temperature Control	Daily (hourly values)	$\leq \pm 2^\circ\text{C}$ SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Temperature Device Check	1/6 mo	$\pm 2^\circ\text{C}$	1, 2 and 3) QA Handbook Volume 2 Section 7.2.2
Monitor Maintenance			
Virtual Impactor (VSCC)	Every 30 days	cleaned/changed	1,2 and 3) Recommendation
Inlet Cleaning	Every 30 days	cleaned	1,2 and 3) Method 2.12 Sec 9.3
Filter Chamber Cleaning	Every 30 days	cleaned	1,2 and 3) Method 2.12 Sec 9.3
Circulating Fan Filter Cleaning	1/mo	cleaned/changed	1,2 and 3) Method 2.12 Sec 9.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
TEOM Specific Operational Criteria			
Total Flow Verification	every 30 days	Sum of flow rates from 3 paths equal design flow rate $\pm 5\%$	1,2 and 3) TEOM SOP Sec 10.1.2
Bypass leak check (TEOM)	every 30 days	± 0.60 lpm	1,2 and 3) TEOM SOP Sec 10.1.6 or TEOM Operating Manual Sec 5-4
Replace TEOM filters	every 30 days	As filter loading approached 100%	1,2 and 3) TEOM SOP Sec 10.1.8
Replace the 47-mm FDMS (Purge) filters	every 30 days or any time TEOM filters are replaced	replaced	1,2 and 3) TEOM SOP Sec 10.1.10
Internal/External Data Logger Data	Every 30 days 10 randomly selected values	agree exactly (digital) and $\pm 1 \mu\text{g}/\text{m}^3$ (analog)	1, 2 and 3) TEOM SOP Sec 10.1.24
Replace In-line filters	1/6 mo	replaced	1, 2 and 3) TEOM SOP Sec 10.2

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
Clean cooler assembly	1/yr	cleaned	1, 2 and 3) TEOM SOP Sec 10.3.1
Clean/Maintain switching valve	1/yr	cleaned	1, 2 and 3) TEOM SOP Sec 10.3.2
Clean air inlet system of mass transducer enclosure	1/yr	cleaned	1, 2 and 3) TEOM SOP Sec 10.3.3
Replace the dryers	1/yr or due to poor performance	replaced	1, 2 and 3) TEOM SOP Sec 10.3.4
Calibration (KO) constant verification	1/yr	Pass or Fail ($\leq 2.5\%$)	1, 2 TEOM SOP Sec 10.3.6 3) 1405-DF operating guide. Verification software either passes or fails the verification. Acceptance criteria is $\leq 2.5\%$
Rebuild sampling pump	18 months	$< 66\%$ of local pressure	1, 2 and 3) TEOM SOP Sec 10.4
GRIMM Specific Operational Criteria			
Internal rinsing air filter	After a few years	Changed	1, 2 and 3) GRIMM SOP Sec 12.4 May require a trained service staff to change. May only require changing if a message reads "check nozzle and air inlet"
Change Dust Filter	1/year	Changed	1, 2 and 3) GRIMM SOP Sec 12.3
BAM Specific Operational Criteria			
Cleaning Nozzle and Van (BAM)	Every 30 days	cleaned	1, 2 and 3) BAM SOP Sec 10.1.3
Replace or Clean pump Muffler	1/6 mo	Cleaned or changed	
Internal/External Data Logger Data (BAM)	Every 30 days 10 randomly selected values	agree exactly (digital) and $\pm 1 \mu\text{g}/\text{m}^3$ (analog)	1, 2 and 3) BAM SOP Sec 10.1.9
Capstan shaft and pinch roller cleaning (BAM)	Every 30 days	cleaned	1, 2 and 3) BAM SOP Sec 10.1.3
Smart Heater Test	1/6 mo	Heater turns when forced off	1, 2 and 3) BAM SOP Sec 10.3.3
Clean/replace internal debris filter	1/year		
72-Hour zero filter test	At installation and 1/year		1, 2 and 3) BAM SOP Sec 9.6.10
Check of membrane span foil	1/year	Avg. $< \pm 5\%$ of ABS	1, 2 and 3) BAM SOP Sec 10.4.3
Beta detector count rate	1/year	Between 600,00 and 1,000,000	1, 2 and 3) BAM SOP Sec 10.4.4
SYSTEMATIC CRITERIA- PM_{2.5} Continuous, Local Conditions			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Data Completeness	quarterly	$\geq 75\%$	Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
Reporting Units	<i>all filters</i>	<i>$\mu\text{g}/\text{m}^3$ at ambient temp/pressure (PM_{2.5})</i>	1, 2 and 3) 40 CFR Part 50 App N Sec 3.0 (b)
Rounding convention for data reported to AQS	<i>all filters</i>	<i>to one decimal place, with additional digits to the right being truncated</i>	1, 2 and 3) 40 CFR Part 50 App N Sec 3.0 (b)

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range	Information /Action
<i>Annual 3-yr average</i>	<i>all concentrations</i>	<i>nearest 0.1 µg/m³ (≥ 0.05 round up)</i>	1,2 and 3) 40 CFR Part 50, App. N Sec 3 and 4 Rounding convention for data reported to AQS is a recommendation
<i>24-hour, 3-year average</i>	<i>all concentrations</i>	<i>nearest 1 µg/m³ (≥ 0.5 round up)</i>	1,2 and 3) 40 CFR Part 50, App. N Sec 3 and 4 Rounding convention for data reported to AQS is a recommendation
Detection Limit			
<i>Lower DL</i>	<i>all filters</i>	<i>≤ 2 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.1
<i>Upper Conc. Limit</i>	<i>all filters</i>	<i>≥ 200 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.2
Verification/Calibration Standards Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	1/yr	± 2% of NIST Traceable Std.	Part 50, App.L Sec 9.1 & 9.2
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.5° C accuracy	Method 2.12 Sec 4.2.2
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	Method 2.12 Sec 4.2.2
Calibration & Check Standards			
Flow Rate Transfer Std.	1/yr	± 2% of NIST-traceable Std.	Part 50, APP L, Sec 9.1 & 9.2
Verification/Calibration			
Clock/timer Verification	1/mo	1 min/mo**	Part 50, App.L, Sec 7.4
Precision			
Single analyzer (collocated monitors)	1/3 mo.	Coefficient of variation (CV) ≤ 10% for values > 3 µg/m ³	1,2 and 3) Recommendation in order to provide early (quarterly) evaluation of achievement of DQOs.
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV ≤ 10% for values > 3 µg/m³</i>	1,2 and 3) 40 CFR Part 58, App A, Sec 4.3.1 and 2.3.1.1 .
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites</i> <i>8 audits for PQAOs with > 5 sites</i>	<i>±10% for values > 3 µg/m³</i>	1,2 and 3) 40 CFR Part 58, App A, Sec 3.2.7, 4.3.2 and 2.3.1.1

1/ value must be flagged due to current implementation of BAM (sampling 42 minute/hour) only 1008 minutes of sampling in 24 hour period

SD= standard deviation , CV= coefficient of variation

** = need to ensure data system stamps appropriate time period with reported sample value

PM10c for PM10-2.5 Low –Volume , Filter-Based Local Conditions Validation Template

NOTE: The following validation template was constructed for use of PM₁₀ at local conditions where PM_{10c} is used in the calculation of the PM_{10-2.5} measurement or for objectives other than comparison to the PM₁₀ NAAQS. Although the PM_{10-2.5} method is found in [40 CFR Part 50 Appendix O](#), Appendix O references Appendix L (the PM_{2.5} Method) for the QC requirements listed below. Therefore, the information action column, in most cases, will reference [40 CFR Part 50 App L](#). Monitoring organizations using PM₁₀ data for a NAAQS comparison purposes should refer to the PM₁₀ validation template for STP (standard temperature and pressure correction). In addition, since the samplers are very similar to the PM_{2.5} samplers, [Guidance Document 2.12 Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods](#) is referred to where appropriate.

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM10c Filter Based Local Conditions			
Field Activities			
Filter Holding Times			
<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 Sec 10.10
<i>Sampling Period (including multiple power failures)</i>	<i>all filters</i>	<i>1380-1500 minutes, or value if < 1380 and exceedance of NAAQS ^{1/2} midnight to midnight local standard time</i>	1, 2 and 3) 40 CFR Part 50 App L Sec 3.3 See details if less than 1380 min sampled
Sampling Instrument			
<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>1/mo</i>	<i>± 4% of transfer standard + 5% of flow rate design value</i>	1, 2 and 3) 40 CFR Part 50, App.L, Sec 9.2.5, 40 CFR Part 58, Appendix A Sec 3.2.3 & 3.3.2
Laboratory Activities			
Post-sampling Weighing	<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
<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
Filter Conditioning Environment			
<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 20-23° 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° 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% - 40% RH or ≤5% sampling RH but > 20%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% 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% RH</i>	1, 2 and 3) 40 CFR Part 50, App.L Sec 8.3.3

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
<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
OPERATIONAL EVALUATIONS TABLE- PM10c Filter Based Local Conditions			
Field Activities			
Sampling Instrument			
<i>Individual Flow Rates</i>	<i>every 24 hours of op</i>	<i>no flow rate excursions > +5% for > 5 min. $\frac{1}{1}$</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 $\frac{1}{1}$</i>	1, 2 and 3) 40 CFR Part 50, App.L Sec 7.4.11.4
Routine Verifications			
<i>External Leak Check</i>	every 5 sampling events	< 80 mL/min (see comment #1)	1) 40 CFR Part 50 App L , Sec 7.4.6.1 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.1
<i>Internal Leak Check</i>	every 5 sampling events	< 80 mL/min	1) 40 CFR Part 50, App.L, Sec 7.4.6.2 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.2
<i>One-point Temp Verification</i>	1/mo	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
<i>Pressure Verification</i>	1/mo	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
<i>Temperature multi-point Verification/Calibration</i>	on installation, then 1/yr	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
<i>Pressure Verification/Calibration</i>	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or 1/yr</i>	± 4% of transfer standard	1) 40 CFR Part 50, App.L, Sec 9.2. 2) 40 CFR Part 50, App.L, Sec 9.1.3, Method 2.12 Table 6-1 3) 40 CFR Part 50, App.L, Sec 9.2.5
<i>Design Flow Rate Adjustment</i>	<i>at one-point or multi-point verification/calibration</i>	± 2% of design flow rate	1,2 and 3) 40 CFR Part 50, App.L, Sec 9.2.6
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1,2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites by method designation</i>	CV ≤ 15% of samples > 3 µg/m ³	1) and 2) Part 58 App A Sec 3.2.5 3 Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.3
Accuracy			
Temperature Audit	1/yr	± 2°C	1, 2 and 3) Method 2.12 Sec. 10.2.2 & Table 3-1

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Pressure Audit	1/yr	±10 mm Hg	1, 2 and 3) Method 2.12 Sec. 10.2.3 & Table 3-1
Semi Annual Flow Rate Audit	1/6 mo	± 4% of audit standard ± 5% of design flow rate	1 and 2) Part 58 App A , Sec 3.3.3 3) Method 2.12 Sec. 10.2.1 & Table 10-1
Monitor Maintenance			
Impactor (WINS)	every 5 sampling events	cleaned/changed	1, 2,and 3) Method 2.12 Sec 8.3.1
Very Sharp Cut Cyclone	every 30 days	cleaned/changed	1,2 and 3) Recommendation
Inlet/downtube Cleaning	every 15 sampling events	cleaned	1,2 and 3) Method 2.12 Sec 9.4.1
Filter Chamber Cleaning	1/mo	cleaned	1, 2 and 3) Method 2.12 Sec 9.3
Circulating Fan Filter Cleaning	1/mo	cleaned/changed	1, 2 and 3) Method 2.12 Sec 9.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	less than 15 µg change between weighings	1, 2 and 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor.
Exposure Lot Blanks	3 filters per lot	less than 15 µg change between weighings	1,2 and 3) Method 2.12 Sec. 7.7 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1,2 and 3) Method 2.12 Sec. 7.10
Filter Holding Times			
Pre-sampling	all filters	< 30 days before sampling	1,2 and 3) 40 CFR Part 50, App.L Sec 8.3.5
Lab QC Checks			
Field Filter Blank	10% or 1 per weighing session	± 30 µg change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.1 2 and 3) Method 2.12 Sec. 7.7
Lab Filter Blank	10% or 1 per weighing session	± 15 µg change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.2 2 and 3) Method 2.12 Sec. 7.7
Balance Check (working standards)	beginning, 10th sample, end	≤3 µg	1,2 and 3) Method 2.12 Sec. 7.9
Duplicate Filter Weighing	1 per weighing session	± 15 µg change between weighings	1,2 and 3) Method 2.12 Sec 7.11
Microbalance Audit	1/yr	± 0.050 mg or manufacturers specs, whichever is tighter	1,2 and 3) Method 2.12 Sec. 10.2.6
Verification/Calibration			
Lab Temperature	1/6 months	± 2°C	1) Method 2.12 Table 3-2 2) Recommendation Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2
Lab Humidity	1/6 months	± 2%	1) Method 2.12 Table 3-2 2) Recommendation Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
<i>Microbalance Calibration</i>	<i>At installation and prior to each weighing session</i> 1/yr	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. 7.2 3) NA
Calibration & Check Standards -			
Working Mass Stds. (compare to primary standards)	1/3 mo.	0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3 and 7.3
SYSTEMATIC CRITERIA - PM10c Filter Based Local Conditions			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Data Completeness	NA	≥ 75% scheduled sampling days in each quarter	1, 2 and 3) Recommendation based on PM2.5 requirements in 40 CFR Part 50, App. N, Sec. 4.1 (b) 4.2 (a)
<i>Reporting Units</i>	<i>all filters</i>	<i>µg/m³ at ambient temp/pressure (PM_{2.5})</i>	1, 2 and 3) 40 CFR Part 50 App N
Rounding convention for data reported to AQS	all concentrations	nearest 0.1 µg/m ³ (≥ 0.05 round up)	1,2 and 3) Recommendation based on PM2.5 requirements 40 CFR Part 50 App N sect 4.3
Detection Limit			
<i>Lower DL</i>	<i>all filters</i>	<i>≤ 3 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App O Sec 3.1
<i>Upper Conc. Limit</i>	<i>all filters</i>	<i>≥ 200 µg/m³</i>	1,2 and 3) 40 CFR Part 50, App.O Sec 3.2
Precision			
Single analyzer (collocated monitors)	1/3 mo.	Coefficient of variation (CV) ≤ 10% for values > 3 µg/m ³	1,2 and 3) Recommendation in order to provide early evaluation of achievement of DQOs.
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV ≤ 10% for values > 3 µg/m³</i>	1,2 and 3) 40 CFR Part 58, App A Sec 4.3.1 and 2.3.1.1
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites</i> <i>8 audits for PQAOs with > 5 sites</i>	<i>±10% for values > 3 µg/m³</i>	1, 2 and 3) 40 CFR Part 58, App A, Sec 3.2.7, 4.3.2 and 2.3.1.1
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	1/yr	<i>± 2% of NIST-traceable Std.</i>	1) 40 CFR Part 50, App.L Sec 9.1 & 9.2 2) Method 2-12 Section 6.3.3 and Table 3-1 3) 40 CFR Part 50, App.L Sec 9.1 & 9.2
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1

1) Criteria (PM10c)	2) Frequency	3) Acceptable Range	Information /Action
Verification/Calibration Clock/timer Verification	1/mo	<i>1 min/mo</i>	1 and 2) Method 2.12 Table 3-1 3) 40 CFR Part 50, App.L, Sec 7.4.12
Laboratory Activities			
<i>Microbalance Readability</i>	<i>at purchase</i>	<i>1 µg</i>	1, 2 and 3)) 40 CFR Part 50, App.L, Sec 8.1
Microbalance Repeatability	1/yr	1 µg	1) Method 2.12 Sec 4.3.6 2) Recommendation 3) Method 2.12 Sec 4.3.6
Primary Mass Stds.	1/yr	0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3.7 & Table 3-2
Comment #1			
The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

1/ value must be flagged , SD= standard deviation, CV= coefficient of variation

PM₁₀ Filter Based Dichot STP Conditions Validation Template

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM₁₀ Filter Based Dichot			
Field Activities			
Filter Holding Times			
<i>Sample Recovery</i>	<i>all filters</i>	<i>ASAP</i>	1,2 and 3) 40 CFR Part 50 App J sec 9.15
<i>Sampling Period</i>	<i>all filters</i>	<i>1440 minutes ± 60 minutes midnight to midnight local standard time</i>	1,2 and 3) 40 CFR Part 50 App J sec 7.1.5
Sampling Instrument			
Average Flow Rate	every 24 hours of op	average 16.67 liters/minute	1,2 and 3) Method 2.10 sec 2.1
Verification/Calibration			
<i>One-point Flow Rate Verification</i>	<i>1/mo</i>	<i>± 7% of transfer standard</i>	1,2 and 3) Method 2.10 Table 3-1
Lab Activities			
Filter			
Visual Defect Check (unexposed)	all filters	see reference	1,2 and 3) Method 2.10 sec 4.2
<i>Collection efficiency</i>	<i>all filters</i>	<i>≥ 99 %</i>	1,2 and 3) Part 50, App J sec 7.2.2
<i>Alkalinity</i>	<i>all filters</i>	<i>< 25.0 microequivalents/gram</i>	1,2 and 3) 40 CFR Part 50, App J sec 7.2.4
Filter Conditioning Environment			
<i>Equilibration</i>	<i>all filters</i>	<i>24 hours minimum</i>	1,2 and 3) 40 CFR Part 50, App.J sec 9.3
<i>Temp. Range</i>	<i>all filters</i>	<i>15-30° C</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.1
<i>Temp.Control</i>	<i>all filters</i>	<i>± 3° C SD* over 24 hr</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.2 SD statistic is recommendation
<i>Humidity Range</i>	<i>all filters</i>	<i>20% - 45% RH</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.3
<i>Humidity Control</i>	<i>all filters</i>	<i>± 5% SD* over 24 hr</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.4 SD use is recommendation
Pre/post Sampling RH	all filters	difference in 24-hr means ≤ ± 5% RH	1,2 and 3) Recommendation based on 40 CFR Part 50, App.L sec 8.3.3
Balance	all filters	located in filter conditioning environment	1,2 and 3) Recommendation based on 40 CFR Part 50, App.L sec 8.3.2
OPERATIONAL EVALUATIONS TABLE PM₁₀ Filter Based Dichot			
Field Activities			
Verification/Calibration			
System Leak Check	During precalibration check	Vacuum of 10 to 15 in. & rate of decline to 0 >60 seconds	1,2 and 3) Method 2.10 sec 2.2.1
<i>FR Multi-point Verification/Calibration</i>	<i>1/yr</i>	<i>Correlation coefficient of >.990 with no point deviating more than 0.5 L/min for total or 0.05 L/min for coarse</i>	1) 40 CFR Part 50, App.J, sec 8.0 2 and 3) Method 2.10 Sec 2.2.4
Field Temp M-point Verification	on installation, then 1/yr	± 2°C	1,2 and 3) Recommendation based on Part 50, App.L
Precision			

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites</i>	<i>5 µg/m³ for concentrations below 80µg/m³ and 7% for concentrations above 80µg/m³</i>	1 and 2) 40 CFR Part 58 App A sec 3.3.1 3) Part 50, App J sec 4.1
<i>Semi Annual Flow Rate Audit</i>	1/6 mo	± 10% of audit standard	1 and 2) 40 CFR Part 58, App A , sec 3.3.3 3) Method 2.10 Sec 7.1.5
Monitor Maintenance			
Impactor	1/3 mo	cleaned/changed	1,2 and 3) Method 2.10 sec 6.1.2
Inlet/downtube Cleaning	1/3 mo	cleaned	1,2 and 3) Method 2.10 sec 6.1.2
Vacuum pump	1/yr	Replace diaphragm and flapper valves	1,2 and 3) Method 2.10 sec 6.1.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Lab Activities			
Balance Check	beginning, 10th sample, end	≤ 4 µg of true zero ≤ 2 µg of 10 mg check weight	1,2 and 3) Method 2.10 sec 4.5
“Standard” filter QC check	10%	± 20 µg change from original value	1,2 and 3) Method 2.10 sec 4.5 From standard non-routine filter
“Routine” duplicate weighing	5-7 per weighing session	± 20 µg change from original value	1,2 and 3) Method 2.10 sec 4.5 From routine filter set
<i>Integrity</i> - Random sample of test field blank filters	10%	± 5 µg/m ³	1) 40 CFR Part 50 App J sec 7.2.3 2 and 2) Recommendation 3) 40 CFR Part 50 App J sec 7.2.3
Lab Temperature Calibration	1/6 months	± 2°C	1,2 and 3) Recommendation related to 40 CFR Part 50, App.L
Lab Humidity Calibration	1/6 months	± 2%	1,2 and 3) Recommendation related to 40 CFR Part 50 App L sec 5.8.1
Microbalance Calibration	1/yr	Manufacturer's specification	1,2 and 3) Recommendation related to 40 CFR Part 50 App L
Filter Weighing Audit	1/yr	± 20 µg change from original value	1,2 and 3) Method 2.10 Table 7-1
Balance Audit	1/yr	Observe weighing technique and check balance with ASTM Class 1 standard	1,2 and 3) Method 2.10 Table 7-1 section 7.2.2
SYSTEMATIC CRITERIA - PM₁₀ Filter Based Dichot			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
<i>Data Completeness</i>	<i>24- Hour Standard</i>	<i>≥ 75% scheduled sampling days in each quarter</i>	1,2 and 3) 40 CFR Part 50 App. K, sec. 2.3b
Reporting Units	all filters	µg/m ³ at standard temperature and pressure	1,2 and 3) 40 CFR Part 50 App K

1) Criteria (PM10 Dichot STP)	2) Frequency	3) Acceptable Range	Information /Action
<i>Rounding convention for data reported to AQS</i>	<i>Each routine concentration</i>	<i>nearest 10 µg/m³ (≥ 5 round up)</i>	1,2 and 3) 40 CFR Part 50 App K sec 2
Precision			
Single analyzer	1/3 mo.	Coefficient of variation (CV) ≤ 10% > 3 µg/m ³	1,2 and 3) Recommendation 3 µg/m ³ cut off in 40 CFR part 58 App A sec 4
Single analyzer	1/ yr	CV ≤ 10% > 3 µg/m ³	1,2 and 3) Recommendation 3µg/m ³ cut off in 40 CFR part 58 App A sec 4
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV ≤ 10% > 3 µg/m ³	1,2 and 3) Recommendation 3µg/m ³ cut off in 40 CFR part 58 App A sec 4
Field Activities			
Verification/Calibration Standards and Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	<i>1/yr</i>	<i>+ 2% of NIST-traceable Std.</i>	1,2 and 3) 40 CFR Part 50 App J sec 7.3
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.1° C accuracy	1,2 and 3) Method 2.10 section 1.1.2
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1,2 and 3) Method 2.10 section 1.1.2
Clock/timer Verification	1/6 mo	15 min/day	1,2 and 3) Method 2.10 sec 9
Lab Activities			
Microbalance	at purchase	Readability 1 µg, Repeatability 1 µg	1,2 and 3) Method 2.10 sec 4.4
Primary Mass Stds. (compare to NIST-traceable standards)	1/yr	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1,2 and 3) Method 2.10 sec 9

*SD= standard deviation CV= coefficient of variation

PM₁₀ Filter Based High Volume (HV) STP Conditions Validation Template

1) Criteria (PM ₁₀ Hi-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM₁₀ Filter Based Hi-Vol			
Field Activities			
Filter Holding Times			
<i>Sample Recovery</i>	<i>all filters</i>	<i>ASAP</i>	1,2 and 3) 40 CFR Part 50 App J sec 9.15
Sampling Period	all filters	1440 minutes ± 60 minutes midnight to midnight local standard time	1,2 and 3) 40 CFR Part 50 App J sec 7.1.5
Average Flow Rate	every 24 hours of op	~1.13 m ³ /min (varies with instrument)	1,2 and 3) Method 2.11
Verification/Calibration			
<i>One-point Flow Rate Verification</i>	<i>1/3 mo</i>	± 7% of transfer standard and 10% from design	1 and 2) 40 CFR Part 58, App A, sec 3.2.3 3) Method 2.11 sec 3.5.1, Table 2-1
Lab Activities			
Filter			
Visual Defect Check (unexposed)	<i>all filters</i>	<i>see reference</i>	Method 2.11 sec 4.2
<i>Collection efficiency</i>	<i>all filters</i>	<i>99 %</i>	1,2 and 3) 40 CFR Part 50, App J sec 7.2.2
<i>Alkalinity</i>	<i>all filters</i>	<i>< 25.0 microequivalents/gram</i>	1,2 and 3) 40 CFR Part 50, App J sec 7.2.4
Filter Conditioning Environment			
<i>Equilibration</i>	<i>all filters</i>	<i>24 hours minimum</i>	1,2 and 3) 40 CFR Part 50, App.J sec 9.3
<i>Temp. Range</i>	<i>all filters</i>	<i>15-30° C</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.1
<i>Temp. Control</i>	<i>all filters</i>	<i>+ 3° C SD* over 24 hr</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.2
<i>Humidity Range</i>	<i>all filters</i>	<i>20% - 45% RH</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.3
<i>Humidity Control</i>	<i>all filters</i>	<i>+ 5% SD* over 24 hr</i>	1,2 and 3) 40 CFR Part 50, App.J sec 7.4.4
Pre/post Sampling RH	all filters	difference in 24-hr means ≤ ± 5% RH	1,2 and 3) Recommendation based on Part 50, App.L sec 8.3.3
Balance	all filters	located in filter conditioning environment	1,2 and 3) Recommendation based on Part 50, App.L sec 8.3.2
OPERATIONAL EVALUATIONS TABLE PM₁₀ Filter Based Hi-Vol			
Field Activities			
Verification/Calibration			
System Leak Check	During precalibration check	Auditory inspection with faceplate blocked	1,2 and 3) Method 2.11 sec 2.3.2
FR Multi-point Verification/Calibration	1/yr	3 of 4 cal points within ± 10% of design	1, 2 and 3) Method 2.11 sec 2.3.2
Field Temp M-point Verification	on installation, then 1/yr	± 2°C	1,2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites</i>	CV ≤ 10% of samples > 15 µg/m ³	1) and 2) 40 CFR Part 58 App A sec 3.2.5 3) Recommendation
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	± 7% of transfer standard and 10% from design	1 and 2) 40 CFR Part 58, App A, sec 3.3.3 3) Method 2.11 sec 7 Table 7-1
Monitor Maintenance			
Inlet/downtube Cleaning	1/3 mo	cleaned	1, 2 and 3) Method 2.11 sec 6
Motor/housing gaskets	1/3 mo	Inspected replaced	1, 2 and 3) Method 2.11 sec 6

1) Criteria (PM10 Hi-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Blower motor brushes	600-1000 hours	Replace	1, 2 and 3) Method 2.11 sec 6
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	NA
Lab Activities			
Lab QC Checks			
Balance Check (Standard Weight Check and Calibration Check)	beginning, 15th sample, end	± 0.5 mg of true zero and ± 0.5 mg 1-5 g check weight	1,2, and 3) Method 2.11 sec 4.5.1 and 4.5.2
"Routine" duplicate weighing	5-7 per weighing session	± 2.8 mg change from original value	1,2 and 3) Method 2.11 sec 4.5.3 From routine filter set
<i>Integrity</i> - Random sample of test field blank filters	10%	$\pm 5 \mu\text{g}/\text{m}^3$	1) 40 CFR Part 50 App J sec 7.2.3 2) Recommendation 3) 40 CFR Part 50 App J sec 7.2.3
Lab Temperature Calibration	1/6 months	$\pm 2^\circ\text{C}$	1,2 and 3) Recommendation related to 40 CFR Part 50, App.L
Lab Humidity Calibration	1/6 months	$\pm 2\%$	1,2 and 3) Recommendation related to 40 CFR Part 50 App L
Microbalance Calibration	1/yr	Manufacturer's specification	
Audits			
Filter Weighing	1/yr	± 5 mg change from original value	1) Method 2.11 Table 7-1 2) Recommendation 3) Method 2.11 Table 7-1
Balance Audit	1/yr	Observe weighing technique and check balance with ASTM Class 1 standard	1) Method 2.11 Table 7-1 2) Recommendation 3) Method 2.11 Table 7-1
SYSTEMATIC CRITERIA - PM₁₀ Filter Based Hi-Vol			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Data Completeness	quarterly	$\geq 75\%$	1,2 and 3) 40 CFR Part 50 App. K, sec. 2.3b & c
Reporting Units	all filters	$\mu\text{g}/\text{m}^3$ at standard temperature and pressure	1,2 and 3) 40 CFR Part 50 App K sec. 1
Rounding convention for data reported to AQS	<i>Each routine concentration</i>	<i>nearest 10 $\mu\text{g}/\text{m}^3$ (≥ 5 round up)</i>	1,2 and 3) 40 CFR Part 50 App K sec 1
Precision			
Single analyzer	1/3 mo.	Coefficient of variation (CV) $\leq 10\% > 15 \mu\text{g}/\text{m}^3$	1,2 and 3) Recommendation
Single analyzer	1/ yr	$\text{CV} \leq 10\% > 15 \mu\text{g}/\text{m}^3$	1,2 and 3) Recommendation
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV $\leq 10\% > 15 \mu\text{g}/\text{m}^3$	1,2 and 3) Recommendation
Field Activities			

1) Criteria (PM10 Hi-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Verification/Calibration Standards and Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
Flow Rate Transfer Std.	1/yr	± 2% of NIST-traceable Std.	1) 40 CFR Part 50, App.J sec 7.3 2) Method 2.11 Sec 1.1.3 3) 40 CFR Part 50, App.J sec 7.3
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.5° C accuracy	1,2 and 3) Method 2.11 Sec 1.1.2
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1,2 and 3) Method 2.11 Sec 1.1.2
Clock/timer Verification	4/year	5 min/mo	recommendation
Lab Activities			
<i>Microbalance</i>	<i>at purchase</i>	Readability 0.1 mg Repeatability 0.5 mg (HV)	1 and 2) 40 CFR Part 50, App.J sec 7.5 3) Method 2.11 sec 4.4
Primary Mass Stds. (compare to NIST-traceable standards)	1/yr	NIST traceable (e.g., ANSI/ASTM Class 1, 1.1 or 2)	1,2 and 3) Method 2.11 sec 9

SD= standard deviation CV= coefficient of variation

Continuous PM10 STP Conditions Validation Template

NOTE: There are a number of continuous PM10 monitors that are designated as FEM. These monitors may have different measurement or sampling attributes that cannot be identified in this validation template. Monitoring organizations should review specific instrument operating manuals and augment the validation template with QC information specific to their EPA reference or equivalent method designation and instrument.” <http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf>. In general, 40 CFR Part 58 App A and 40 CFR Part 50 App J requirements apply to Continuous PM10. Since a guidance document was never developed for continuous PM10, many of the requirements reflect a combination of manual and continuous PM2.5 requirements and are therefore considered recommendations.

1) Criteria (PM ₁₀ Cont)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM₁₀ Continuous			
Sampling Period	all filters	1440 minutes ± 60 minutes midnight to midnight local standard time	1,2 and 3) 40 CFR Part 50 App J sec 7.1.5
Average Flow Rate	every 24 hours of op	Average within ± 5% of design	recommendation
Verification/Calibration			
<i>One-point Flow Rate Verification</i>	<i>1/mo</i>	± 7% of transfer standard	1 and 2) 40 CFR Part 58, App A , sec 3.2.3 3) Method 2.10 Table 3-1
OPERATIONAL EVALUATIONS TABLE PM₁₀ Continuous			
Verification/Calibration			
System Leak Check	During precalibration check	Auditory inspection with faceplate blocked	1,2 and 3) Method 2.11 sec 2.3.2
<i>FR Multi-point Verification/Calibration</i>	1/yr	3 of 4 cal points within ± 10% of design	1) 40 CFR Part 50 App J sec 8.0 2 and 3) Method 2.10 Sec 2.2.4
Audits			
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	± 10% of audit standard	1,2) Part 58, App A, sec 3.2.4 3) Method 2.10 Sec 7.1.5
Monitor Maintenance			
Inlet/downtube Cleaning	1/3 mo	cleaned	1,2 and 3) Method 2.10 sec 6.1.2
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
SYSTEMATIC CRITERIA - PM₁₀ Continuous			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
Data Completeness	24-hour quarterly	$\frac{23 \text{ hours}}{\geq 75\%}$	Recommendation 40 CFR Part 50 App. K, sec. 2.3
Reporting Units	all filters	µg/m ³ at standard temperature and pressure (STP)	40 CFR Part 50 App K

1) Criteria (PM ₁₀ Cont)	2) Frequency	3) Acceptable Range	Information /Action
Rounding convention for data reported to AQS			
24-hour, 3-year average	quarterly	nearest 10 µg/m ³ (≥ 5 round up)	40 CFR Part 50 App K sec 1
Verification/Calibration Standards and Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	<i>1/yr</i>	<i>+ 2% of NIST-traceable Std.</i>	1,2 and 3) 40 CFR Part 50 App J sec 7.3
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.1° C accuracy	1,2 and 3) Method 2.10 section 1.1.2
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1,2 and 3) Method 2.10 section 1.1.2
Clock/timer Verification	1/6 mo	15 min/day	1,2 and 3) Method 2.10 sec 9

PM₁₀ Low Volume STP Filter-Based Local Conditions Validation Template

Monitoring organizations can use low-volume PM instruments for PM₁₀ monitoring. However, PM₁₀ data collection for NAAQS purposes must be reported in standard temperature and pressure (STP). 40 CFR Part 50 App J describes the reference method for PM₁₀ but this method was promulgated for dichot and high volume methods that have improved over the years. Since monitoring organization may be able to use the low volume methods for multiple uses (PM_{10c}, PM₁₀-Pb) it is suggested that the validation criteria for this method follow the method requirements associated with the PM_{2.5} which is Appendix L. Where there are particular requirement directly related to the NAAQS evaluation App J will be used.

1) Criteria (PM ₁₀ Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM₁₀ Lo-Vol Filter Based STP			
Field Activities			
Filter Holding Times			
<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 Sec 10.10
<i>Sampling Period (including multiple power failures)</i>	<i>all filters</i>	<i>1440 minutes ± 60 minutes midnight to midnight local standard time</i>	1,2 and 3) 40 CFR Part 50 App J sec 7.1.5
Sampling Instrument			
<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>	1/mo	<i>± 4% of transfer standard ± 5% of flow rate design value</i>	1) 40 CFR Part 50, App.L, Sec 9.2.5, 40 CFR Part 58, Appendix A Sec 3.2.3 & 3.3.2 2) Recommendation 3) 40 CFR Part 50, App.L, Sec 9.2.5 & 7.4.3.1
Laboratory Activities			
<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
<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
Filter Conditioning Environment			
<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 20-23° 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° 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% - 40% RH or ≤5% sampling RH but > 20%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% 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% 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

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
OPERATIONAL EVALUATIONS TABLE PM₁₀ Lo-Vol Filter Based STP			
Field Activities			
Sampling Instrument			
<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
Routine Verifications			
<i>External Leak Check</i>	every 5 sampling events	< 80 mL/min (see comment #1)	1) 40 CFR Part 50 App L , Sec 7.4.6.1 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.1
<i>Internal Leak Check</i>	every 5 sampling events	< 80 mL/min	1) 40 CFR Part 50, App.L, Sec 7.4.6.2 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.2
<i>One-point Temp Verification</i>	1/mo	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
<i>Pressure Verification</i>	1/mo	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
<i>Temperature multi-point Verification/Calibration</i>	on installation, then 1/yr	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
<i>Pressure Verification/Calibration</i>	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or 1/yr</i>	± 4% of transfer standard	1) 40 CFR Part 50, App.L, Sec 9.2. 2) 40 CFR Part 50, App.L, Sec 9.1.3, Method 2.12 Table 6-1 3) 40 CFR Part 50, App.L, Sec 9.2.5
<i>Design Flow Rate Adjustment</i>	<i>at one-point or multi-point verification/calibration</i>	± 2% of design flow rate	1,2 and 3) 40 CFR Part 50, App.L, Sec 9.2.6
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1,2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>every 12 days for 15% of sites</i>	CV ≤ 10% of samples > 3 µg/m ³	1) and 2) 40 CFR Part 58 App A Sec 3.2.5 3) Recommendation
Accuracy			
Temperature Audit	1/yr	± 2°C	1, 2 and 3) Method 2.12 Sec. 10.2.2 & Table 3-1
Pressure Audit	1/yr	±10 mm Hg	1, 2 and 3) Method 2.12 Sec. 10.2 & Table 3-1

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Semi Annual Flow Rate Audit	1/6 mo	$\pm 4\%$ of audit standard $\pm 5\%$ of design flow rate	1 and 2) Part 58, App A, Sec 3.3.3 3) Method 2.12 Sec. 10.2.1 & Table 10-1
Monitor Maintenance			
Impactor (WINS)	every 5 sampling events	cleaned/changed	1, 2, and 3) Method 2.12 Sec 8.3.1
Very Sharp Cut Cyclone	every 30 days	cleaned/changed	1,2 and 3) Recommendation
Inlet/downtube Cleaning	every 15 sampling events	cleaned	1,2 and 3) Method 2.12 Sec 9.3 & 9.4.1
Filter Chamber Cleaning	1/mo	cleaned	1, 2 and 3) Method 2.12 Sec 9.3
Circulating Fan Filter Cleaning	1/mo	cleaned/changed	1, 2 and 3) Method 2.12 Sec 9.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities			
Filter Checks			
Lot Blanks	9 filters per lot	less than 15 μg change between weighings	1, 2, 3) Recommendation and used to determine filter stability of the lot of filters received from EPA or vendor.
Exposure Lot Blanks	3 filters per lot	less than 15 μg change between weighings	1,2 and 3) Method 2.12 Sec. 7.7 Used for preparing a subset of filters for equilibration
Filter Integrity (exposed)	each filter	no visual defects	1,2 and 3) Method 2.12 Sec. 7.10
Filter Holding Times			
Pre-sampling	all filters	< 30 days before sampling	1,2 and 3) 40 CFR Part 50, App.L Sec 8.3.5
Lab QC Checks			
Field Filter Blank	10% or 1 per weighing session	$\pm 30 \mu\text{g}$ change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.1 2 and 3) Method 2.12 Sec. 7.7
Lab Filter Blank	10% or 1 per weighing session	$\pm 15 \mu\text{g}$ change between weighings	1) 40 CFR Part 50, App.L Sec 8.3.7.2 2 and 3) Method 2.12 Sec. 7.7
Balance Check (working standards)	beginning, 10th sample, end	$\leq 3 \mu\text{g}$	1,2 and 3) Method 2.12 Sec. 7.9
Duplicate Filter Weighing	1 per weighing session	$\pm 15 \mu\text{g}$ change between weighings	1,2 and 3) Method 2.12 Sec 7.11
Microbalance Audit	1/yr	$\pm 0.050 \text{ mg}$ or manufacturers specs, whichever is tighter	1,2 and 3) Method 2.12 Sec. 10.2.6
Verification/Calibration			
Lab Temperature	1/6 months	$\pm 2^\circ\text{C}$	1) Method 2.12 Table 3-2 2) Recommendation Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2
Lab Humidity	1/6 months	$\pm 2\%$	1) Method 2.12 Table 3-2 2) Recommendation Table 3-2 suggests every 3 mo. 3) Method 2.12 Table 3-2

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
<i>Microbalance Calibration</i>	<i>At installation and prior to each weighing session</i> 1/yr	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. 7.2 3) NA
Calibration & Check Standards -			
Working Mass Stds. (compare to primary standards)	1/3 mo.	0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3 and 7.3
SYSTEMATIC CRITERIA - PM₁₀ Lo-Vol Filter Based STP			
<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>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
<i>Data Completeness</i>	<i>24- Hour Standard</i>	<i>≥ 75% scheduled sampling days in each quarter</i>	1,2 and 3) 40 CFR Part 50 App. K, sec. 2.3b
<i>Reporting Units</i>	all filters	μg/m ³ at standard temperature and pressure	1,2 and 3) 40 CFR Part 50 App K sec. 1
<i>Rounding convention for data reported to AQS</i>	<i>Each routine concentration</i>	<i>nearest 10 μg/m³ (≥ 5 round up)</i>	1,2 and 3) 40 CFR Part 50 App K sec 1
Detection Limit			
<i>Lower DL</i>	<i>all filters</i>	<i>≤ 2 μg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.1
<i>Upper Conc. Limit</i>	<i>all filters</i>	<i>≥ 200 μg/m³</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 3.2
Precision			
Single analyzer	1/3 mo.	Coefficient of variation (CV) ≤ 10% > 3 μg/m ³	1,2 and 3) Recommendation
Single analyzer	1/ yr	CV ≤ 10% > 3 μg/m ³	1,2 and 3) Recommendation
Primary Quality Assurance Org.	Annual and 3 year estimates	90% CL of CV ≤ 10% > 3 μg/m ³	1,2 and 3) Recommendation
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	1/yr	± 2% of NIST Traceable Std.	1) 40 CFR Part 50, App.L Sec 9.1 & 9.2 2) Method 2-12 Section 6.3.3 and Table 3-1 3) 40 CFR Part 50, App.L Sec 9.1 & 9.2
Field Thermometer	1/yr	± 0.1° C resolution, ± 0.5° C accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Field Barometer	1/yr	± 1 mm Hg resolution, ± 5 mm Hg accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Clock/timer Verification	1/mo	1 min/mo	1and 2) Method 2.12 Table 3-1 3) 40 CFR Part 50, App.L Sec 7.4.12
Laboratory Activities			
<i>Microbalance Readability</i>	<i>at purchase</i>	1 μg	1, 2 and 3) 40 CFR Part 50, App.L Sec 8.1

1) Criteria (PM10 Lo-Vol STP)	2) Frequency	3) Acceptable Range	Information /Action
Microbalance Repeatability	1/yr	1 µg	1) Method 2.12 Sec 4.3.6 2) Recommendation 3) Method 2.12 Sec 4.3.6
Primary Mass. Verification/Calibration Standards Recertifications	1/yr	0.025 mg	1, 2 and 3) Method 2.12 Sec 4.3.7 & Table 3-2
Comment #1 <u>The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.</u>			

Pb High Volume (TSP) Local Conditions Validation Template

Note: in 2008, the NAAQS was lowered for Pb and new monitoring rules were promulgated which allowed for the use of federal equivalent analytical methods and the use of PM₁₀ sampling in certain circumstances. The following information is guidance based on the current FRM which is sampling by TSP and analysis by atomic absorption. Information in this table is derived from the TSP sampling method in 40 CFR Part 50 App B, and QA Handbook Method 2.2 (1977). The analytical requirements/guidance is derived from 40 CFR Part 50, App G and QA Handbook Method 2.8 (1981). Monitoring for Pb based on the new NAAQS requirements will begin in calendar year 2010. **Revised and/or additional Pb validation templates will be included in this section (if published before this version of the Handbook) or posted on AMTIC**

1) Criteria	2) Frequency	3) Acceptable Range	4) Information/Action
CRITICAL CRITERIA- Pb in TSP			
Field Activities			
Filter Holding Times			
<i>Sample Recovery</i>	<i>all filters</i>	<i>ASAP</i>	1, 2 and 3) 40 CFR Part 50 App B sec 6.3
<i>Sampling Period</i>	<i>all filters</i>	<i>1440 minutes ± 60 minutes midnight to midnight local standard time</i>	1,2 and 3) 40 CFR Part 50 App B sec 8.15
Sampling Instrument			
<i>Average Flow Rate</i>	<i>every 24 hours of op</i>	<i>1.1-1.70 m³/min (varies with instrument) in actual condition</i>	1, 2 and 3) 40 CFR Part 50 App B sec 8.8
<i>One-point Flow Rate Verification</i>	<i>1/3 mo</i>	<i>±7% from transfer standard</i>	1 and 2) 40 CFR Part 58 App A sec 3.3.4.1 3) Method 2.2 sec 2.6
Lab Activities			
Filter			
<i>Visual Defect Check (unexposed)</i>	<i>all filters</i>	<i>Initial backlight inspection- no pinholes or imperfections. Visual inspection prior to shipping to analytical lab</i>	1,2 and 3) 40 CFR Part 50 App B sec 8.2
<i>Collection Efficiency</i>	<i>all filters</i>	<i>99 %</i>	1,2 and 3) 40 CFR Part 50 App B sec 7.1.4
<i>Pressure Drop Range</i>	<i>all filters</i>	<i>42-54 mm Hg</i>	1,2 and 3) 40 CFR Part 50 App B sec 7.1.5
<i>pH</i>	<i>all filters</i>	<i>6-10</i>	1,2 and 3) 40 CFR Part 50, App B sec 7.1.6
<i>Pb Content</i>	<i>all filters pre-sampling batch check</i>	<i><75 µg/filter</i>	1,2 and 3) 40 CFR Part 50, App G sec 6.1.1.1 Method 2.8 sec 6.2.1. More information relative to whether filters should be corrected for blanks.
<i>Calibration Reproducibility Checks</i>	<i>Beginning, every 10 samples and end</i>	<i>± 5% of value predicted by calibration curve</i>	1,2 and 3) 40 CFR Part 50, App G Sec 9.3 May be FEM dependent
Reagent Blank	Every analytical batch	< LDL	1,2 and 3) Recommendation
Daily Calibration	Daily (on day of analysis)	until good agreement is obtained among replicates	1,2 and 3) Method 2.8 sec 2.8.5
OPERATIONAL EVALUATIONS TABLE Pb in TSP			
Field Activities			
Verification/Calibration			

1) Criteria	2) Frequency	3) Acceptable Range	4) Information/Action
System Leak Check	During precalibration check	Visual and Auditory inspection with faceplate blocked	1, 2 and 3) Recommendation
FR Multi-point Verification/Calibration	After receipt, after motor maintenance or failure of 1-point check and 1/yr	5 points over range of 1.1 to 1.7 m ³ /min within ± 5% limits of linearity	1, 2 and 3) Method 2.2 sec 2.6
Precision			
<i>Collocated Samples</i>	<i>15% of each method code in PQAQO Frequency - every 12 days</i>	CV ≤ 20% of samples > 0.02 µg/m ³ (cutoff value)	1 and 2) 40 CFR Part 58 App A sec 3.3.4.3 3) Recommendation for early evaluation of DQOs
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	± 7% of audit standard	1 and 2) 40 CFR Part 58, App A, sec 3.3.4.1 3) Method 2.2 Table 8.2
Monitor Maintenance			
Inlet cleaning	1/3 mo	cleaned	1,2 and 3) Recommendation
Motor/housing gaskets	~400 hours	Inspected replaced	1, 2 and 3) Method 2.2 sec 7
Blower motor brushes	400-500	Replace	1, 2 and 3) Method 2.2 sec 7
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	NA
Lab Activities			
<i>Analysis Audits</i>	<i>6 strips/quarter 3 at each concentration range</i>	10% (percent difference)	1 and 2) 40 CFR Part 58, App A, sec 3.3.4.2 3) Recommendation
Field Filter Blank	1/quarter	< LDL	1,2 and 3) Recommendation
Lab Blanks	1/ sample run	< LDL	1,2 and 3) Recommendation
Control Standards (1 µg Pb/ml and a standard between 1-10 µg Pb/ml)	1 st , every 10 samples and last sample.	Deviation of < 5% from value predicted by calibration curve	1,2 and 3) Method 2.8 section 5.7.3
SYSTEMATIC CRITERIA - Pb Filter Based Hi-Vol			
<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 Also described in 40 CFR Part 50 App B sec 7.2
<i>Siting</i>	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5
<i>Data Completeness</i>	<i>3-year standard</i>	<i>average of the 3 constituent monthly means ≥ 75% .</i>	1,2 and 3) 40 CFR Part 50 App. R, sec. 4. In addition there are substitution tests that can be used for data not meeting completeness criteria.
<i>Reporting Units</i>	<i>all filters</i>	<i>µg/m³ at local temperature and pressure.</i>	1,2 and 3) 40 CFR Part 50 App R sec 3 (b)
<i>Rounding convention for data reported to AQS (3-month arithmetic mean)</i>	<i>quarterly</i>	<i>Report data to 3 decimal places (data after 3 are truncated.</i>	1,2 and 3) 40 CFR Part 50 App R sec 3 (b)

1) Criteria	2) Frequency	3) Acceptable Range	4) Information/Action
<i>Lower Detectable Limit (AA)</i>	<i>all samples</i>	<i>0.07 µg Pb/m³</i>	1,2 and 3) 40 CFR Part 50 App G sec 2.3
Precision			
Single analyzer	1/3 mo.	Coefficient of variation (CV) ≤ 20% > 0.02 µg/m ³	1 and 2) 40 CFR Part 58 App A sec 3.3.4.3 3) Recommendation related to DQO
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV ≤ 20% > 0.02 µg/m³</i>	1, 2 and 3) 40 CFR Part 58 App A sec 3.3.4.3 and sec 2.3.1.4
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites 8 audits for PQAOs with > 5 sites</i>	<i>95% CL Absolute bias ±15% > 0.02 µg/m³</i>	1, 2 and 3) 40 CFR Part 58 App A sec 3.3.4.4 and sec 2.3.1.4 The PEP include 1 or independent collocated audits and 4 or 6 samples from the monitoring organizations collocated monitor sent to the independent National PEP Laboratory.
Field Activities			
Verification/Calibration Standards and Recertifications - All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	1/yr	<i>Resolution 0.02 m³/min ± 2% reproducibility</i>	1) 40 CFR Part 50, App.B sec 7.8 2) Method 2.2 section 2.5 3) 40 CFR Part 50, App.B sec 7.8
<i>Field Thermometer</i>	1/yr	<i>2° C resolution</i>	1) 40 CFR Part 50, App.B sec 7.5 2) Recommendation 3) 40 CFR Part 50, App.B sec 7.5
<i>Field Barometer</i>	1/yr	<i>± 5 mm Hg resolution</i>	1) 40 CFR Part 50, App.B sec 7.6 2) Recommendation 3) 40 CFR Part 50, App.B sec 7.6
Clock/timer Verification	1/3 mo.	± 2 min/24-hour	R1,2 and 3) Method 2.2. section 2.3
Lab Activities			
Analytical Standards			
<i>Reagents (HNO₃ and HCL)</i>	<i>all</i>	<i>ACS reagent grade</i>	1, 2 and 3) 40 CFR Part 50 App G sec.6.2.1
<i>Pb nitrate Pb (NO₃)₂</i>	<i>all</i>	<i>ACS reagent grade (99.0% purity)</i>	1, 2 and 3) 40 CFR Part 50 App G sec.6.2.8

SD= standard deviation

CV= coefficient of variation

PM₁₀ -Pb Low Volume Filter-Based Local Conditions Validation Template

NOTE: The following validation template was constructed for use of PM₁₀-Pb at local conditions where PM_{10c} method in 40 CFR Part 50 Appendix O is referenced. Although the PM_{10-2.5} method is found in [40 CFR Part 50 Appendix O](#), Appendix O also references Appendix L (the PM_{2.5} Method) for the QC requirements listed below. Therefore, the information action column, in most cases, will reference [40 CFR Part 50 App L](#). In addition, since the PM10 samplers are very similar to the PM2.5 samplers, [Guidance Document 2.12. Monitoring PM2.5 in Ambient Air Using Designated Reference or Class 1 Equivalent Methods](#) is referred to where appropriate. At present the only analytical FRM is XRF. Therefore quality control criteria are associated with the XRF method which is promulgated in [40 CFR Part 50 Appendix Q](#).

1) Criteria (PM10-Pb Lo-Vol)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- PM10-Pb Filter Based Local Conditions			
Field Activities			
Filter Holding Times Sample Recovery	<i>all filters</i>	<i>ASAP</i>	1, 2 and 3) 40 CFR part 50 App B sec 6.3 If filters are used for more than one purpose (i.e.,Pb and PM10) the sample recovery is dictated by the most stringent requirement.
Sampling Period (including multiple power failures)	<i>all filters</i>	<i>1440 minutes ± 60 minutes midnight to midnight local standard time</i>	1,2 and 3) 40 CFR Part 50 App B sec 8.15 If filters are used for more than one purpose (i.e.,Pb and PM10) the sample recovery is dictated by the most stringent requirement.
Sampling Instrument			
Average Flow Rate	<i>every 24 hours of op</i>	<i>average within 5% of 16.67 liters/minute</i>	1, 2 and 3) 40 CFR Part 50 App L Sec 7.4.3.1
Variability in Flow Rate	<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
One-point Flow Rate Verification	1/mo	<i>± 4% of transfer standard ± 5% of flow rate design value</i>	1) 40 CFR Part 50, App.L, Sec 9.2.5, 40 CFR Part 58, Appendix A Sec 3.2.3 & 3.3.2 2) Recommendation 3) 40 CFR Part 50, App.L, Sec 9.2.5
Laboratory Activities(XRF Analysis)			
Filter Visual Defect Check (unexposed)	<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
Pb blank filter Acceptance Testing	<i>~ 20 test filters per lot</i>	<i>90% of filters < 4.8 ng Pb/cm²</i>	1, 2 and 3) 40 CFR Part 50 App Q Sec 6.1.2
OPERATIONAL EVALUATIONS TABLE- PM10-Pb Filter Based Local Conditions			
Field Activities			
Sampling Instrument			
Individual Flow Rates	<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

1) Criteria (PM10-Pb Lo-Vol)	2) Frequency	3) Acceptable Range	Information /Action
<i>Filter Temp Sensor</i>	<i>every 24 hours of op</i>	<i>no excursions of > 5° C lasting longer than 30 min</i> <i>1/</i>	1, 2 and 3) 40 CFR Part 50, App.L Sec 7.4
Routine Verifications			
<i>External Leak Check</i>	every 5 sampling events	< 80 mL/min (see comment #1)	1) 40 CFR Part 50 App L , Sec 7.4.6.1 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.1
<i>Internal Leak Check</i>	every 5 sampling events	< 80 mL/min	1) 40 CFR Part 50, App.L, Sec 7.4.6.2 2) Method 2-12 Table 8-1 3) 40 CFR Part 50, App.L, Sec 7.4.6.2
<i>One-point Temp Verification</i>	1/mo	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
<i>Pressure Verification</i>	1/mo	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2) Method 2.12 Table 6-1 3) Recommendation
Annual Multi-point Verifications/Calibrations			
<i>Temperature multi-point Verification/Calibration</i>	on installation, then 1/yr	± 2°C	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.4
<i>Pressure Verification/Calibration</i>	on installation, then 1/yr	± 10 mm Hg	1) 40 CFR Part 50, App.L, Sec 9.3 2 and 3) Method 2.12 sec 6.5 Sampler BP verified against independent standard verified against a lab primary standard that is certified as NIST traceable 1/year
<i>Flow Rate Multi-point Verification/ Calibration</i>	<i>Electromechanical maintenance or transport or</i> 1/yr	± 4% of transfer standard	1) 40 CFR Part 50, App.L, Sec 9.2. 2) 40 CFR Part 50, App.L, Sec 9.1.3, Method 2.12 Table 6-1 3) 40 CFR Part 50, App.L, Sec 9.2.5
<i>Design Flow Rate Adjustment</i>	<i>at one-point or multi-point verification/calibration</i>	± 2% of design flow rate	1,2 and 3) 40 CFR Part 50, App.L, Sec 9.2.2
Other Monitor Calibrations	per manufacturers' op manual	per manufacturers' operating manual	1,2 and 3) Recommendation
Precision			
<i>Collocated Samples</i>	<i>15% of each method code in PQA0</i> <i>Frequency - every 12 days</i>	CV ≤ 20% of samples > 0.02 µg/m ³ (cutoff value)	1 and 2) 40 CFR Part 58 App A sec 3.3.4.3 3) Recommendation for early evaluation of DQOs
Accuracy			
Temperature Audit	1/yr	± 2°C	1, 2 and 3) Method 2.12 Sec. 10.2.2 & Table 3-1
Pressure Audit	1/yr	±10 mm Hg	1, 2 and 3) Method 2.12 Sec. 10.2.3 & Table 3-1
<i>Semi Annual Flow Rate Audit</i>	<i>1/6 mo</i>	± 4% of audit standard ± 5% of design flow rate	1 and 2) 40 CFR Part 58 App A, Sec 3.3.3 3) Method 2.12 Sec. 10.2.1 & Table 10-1
Monitor Maintenance			

1) Criteria (PM10-Pb Lo-Vol)	2) Frequency	3) Acceptable Range	Information /Action
Impactor (WINs)	every 5 sampling events	cleaned/changed	1, 2,and 3) Method 2.12 Sec 8.3.1
Very Sharp Cut Cyclone	every 30 days	cleaned/changed	1,2 and 3) Recommendation
Inlet/downtube Cleaning	every 15 sampling events	cleaned	1,2 and 3) Method 2.12 Sec 9.3 & 9.4.1
Filter Chamber Cleaning	1/mo	cleaned	1, 2 and 3) Method 2.12 Sec 9.3
Circulating Fan Filter Cleaning	1/mo	cleaned/changed	1, 2 and 3) Method 2.12 Sec 9.3
Manufacturer-Recommended Maintenance	per manufacturers' SOP	per manufacturers' SOP	
Laboratory Activities (XRF Analysis)			
Filter Holding Times Pre-sampling	<i>all filters</i>	<i>< 30 days before sampling</i>	1,2 and 3) 40 CFR Part 50, App.L Sec 8.3.5 Required only if filters will be used for PM10c mass as well as Pb. If only used for Pb then 30 day pre-sampling holding time not required
Analysis Audits	<i>6 filters/quarter 3 at each concentration range</i>	10% (percent difference)	1 and 2) 40 CFR Part 58, App A, sec 3.3.4.2 3) Recommendation
Field Filter Blank	1/quarter	$< 0.01 \mu\text{g}/\text{m}^3$	1) 40 CFR Part 50 App Q sec 6.1.2.1 2 and 3) Recommendation
Lab Filter Blank	1/ sample run	$<.003 \mu\text{g}/\text{m}^3$	1 40 CFR part 50 App Q sec 6.1.2.1 2 and 3) Recommendation
Thin Film Standards (standard reference materials)	Beginning and end of each analytical run	XRF conc. $\pm 3x$ the 1 sigma uncertainty overlaps the NIST certified conc. + 1x its reported uncertainty.	1) 40 CFR Part 50 App Q sec 6.2.3 2 and 3) recommendation
Run time quality control standards Checking peak areas, background areas, centroid and FWHM	Beginning and end of each analytical run	Target value ± 3 SD	1,2,and 3) Recommendation Target values and SD of QC samples established prior to analysis.
XRF analyzer calibration	<i>1/year or when significant repairs or changes occur or QC limits exceeded</i>	XRF conc. $\pm 3x$ the 1 sigma uncertainty overlaps the NIST certified conc. + 1x its reported uncertainty.	1 and 2) 40 CFR Part 50 App Q sec 6.2.4 3) Recommendation
Background Measurement and Correction	<i>20 clean blank filters for each filter lot used</i>	NA	1 and 2) 40 CFR Part 50 App Q sec 6.2.4.2
SYSTEMATIC CRITERIA - PM10-Pb Filter Based Local Conditions			
Sampler/Monitor	NA	<i>Meets requirements listed in FRM/FEM designation</i>	1) 40 CFR Part 58 App C Section 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
Siting	1/year	<i>Meets siting criteria or waiver documented</i>	1) 40 CFR Part 58 App E, sections 2-5 2) Recommendation 3) 40 CFR Part 58 App E, sections 2-5

1) Criteria (PM10-Pb Lo-Vol)	2) Frequency	3) Acceptable Range	Information /Action
<i>Data Completeness</i>	<i>3-year standard</i>	<i>average of the 3 constituent monthly means $\geq 75\%$.</i>	1,2 and 3) 40 CFR Part 50 App. R, sec. 4. In addition there are substitution tests that can be used for data not meeting completeness criteria.
<i>Reporting Units</i>	<i>all filters</i>	<i>$\mu\text{g}/\text{m}^3$ at local temperature and pressure.</i>	1,2 and 3) 40 CFR Part 50 App R sec 3 (b)
<i>Rounding convention for data reported to AQS (3-monthmean)</i>	<i>quarterly</i>	<i>Report data to 3 decimal places (data after 3 are truncated).</i>	1,2 and 3) 40 CFR Part 50 App R sec 3 (b)
<i>Lower DL</i>	<i>all filters</i>	<i>$\leq 0.001 \mu\text{g}/\text{m}^3$</i>	1,2 and 3) 40 CFR Part 50 App Q Sec 2.2
<i>Upper Conc. Limit</i>	<i>all filters</i>	<i>$\geq 200 \mu\text{g}/\text{m}^3$</i>	1,2 and 3) 40 CFR Part 50, App.Q Sec 3.1
Precision			
Single analyzer	1/3 mo.	Coefficient of variation (CV) $\leq 20\% > 0.02 \mu\text{g}/\text{m}^3$	1 and 2) 40 CFR Part 58 App A sec 3.3.4.3 3) Recommendation related to DQO
<i>Primary Quality Assurance Org.</i>	<i>Annual and 3 year estimates</i>	<i>90% CL of CV $\leq 20\% > 0.02 \mu\text{g}/\text{m}^3$</i>	1, 2 and 3) 40 CFR Part 58 App A sec 3.3.4.3 and sec 2.3.1.4
Bias			
<i>Performance Evaluation Program (PEP)</i>	<i>5 audits for PQAOs with ≤ 5 sites 8 audits for PQAOs with > 5 sites</i>	<i>95% CL Absolute bias $\pm 15\% > 0.02 \mu\text{g}/\text{m}^3$</i>	1, 2 and 3) 40 CFR Part 58 App A sec 3.3.4.4 and sec 2.3.1.4 The PEP includes 1 or 2 independent collocated audits and 4 or 6 samples from the monitoring organizations collocated monitor sent to the independent National PEP Laboratory.
Field Activities			
Verification/Calibration Standards Recertifications – All standards should have multi-point certifications against NIST Traceable standards			
<i>Flow Rate Transfer Std.</i>	<i>1/yr</i>	<i>$\pm 2\%$ of NIST-traceable Std.</i>	1) 40 CFR Part 50, App.L Sec 9.1 & 9.2 2) Method 2-12 Section 6.3.3 and Table 3-1 3) 40 CFR Part 50, App.L Sec 9.1 & 9.2
Field Thermometer	1/yr	$\pm 0.1^\circ \text{C}$ resolution, $\pm 0.5^\circ \text{C}$ accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Field Barometer	1/yr	$\pm 1 \text{ mm Hg}$ resolution, $\pm 5 \text{ mm Hg}$ accuracy	1, 2 and 3) Method 2.12 Sec 4.2.2 & Table 3-1
Verification/Calibration Clock/timer Verification	1/mo	<i>1 min/mo</i>	1 and 2) Method 2.12 Table 3-1 3) 40 CFR Part 50, App.L, Sec 7.4.12
Comment #1 The associated leak test procedure shall require that for successful passage of this test, the difference between the two pressure measurements shall not be greater than the number of mm of Hg specified for the sampler by the manufacturer, based on the actual internal volume of the sampler, that indicates a leak of less than 80 mL/min.			

1/ value must be flagged SD= standard deviation CV= coefficient of variation