



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

TECHNICAL SERVICES DIVISION
QUALITY ASSURANCE PROJECT PLAN
STANDARD OPERATING PROCEDURE

DATA MGT SOP 603
PM_{2.5}

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STANDARD OPERATING PROCEDURE
BAAQMD Technical Services Division

PM_{2.5} Sampler Data Management

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Purpose

The purpose of this Data Management Standard Operating Procedure (SOP) is to document data validation procedures for the PM_{2.5} samplers used by BAAQMD to measure PM_{2.5} mass concentrations. The goal is to define the staff persons responsible for the review, a review timeline, and the specific steps and objectives of the review process.

Background

The District has installed Partisol-Plus 2025 samplers to measure PM_{2.5} mass concentrations. This instrument is certified by EPA as a reference method for PM_{2.5}. The data are submitted to the Air Quality System (AQS).

Procedure Summary

Data review begins with the Air Monitoring (AM) Section staff that installs, operates and maintains the PM_{2.5} samplers. AM is responsible for following approved PM_{2.5} sampling SOPs and is the final authority in determining whether the PM_{2.5} instrument is operating correctly and thus providing valid data. AM is responsible for following approved filter handling and shipping SOPs. AM is responsible for ensuring PM_{2.5} sampling summary information for each filter run is properly retrieved and forwarded to the laboratory database. Instrument parameters (such as Elapsed Time, Actual Start Time, and Average Flow Rate) shall be utilized by AM to assist in the data validation process. AM is responsible for noting the local sampling conditions, sampler error flags, and determining if the samples and instrument sampling parameters meet EPA and CARB quality control standards.

A second data review is conducted by the Laboratory staff that analyzes the PM_{2.5} filters. The Laboratory is responsible for following approved filter handling SOPs. The Laboratory

conducts a secondary visual inspection of the filter, and reviews the field sampling parameters to determine compliance with quality control standards. The Laboratory also retrieves sample summary data from the instruments for each sample run, reviews PM_{2.5} data entries, and forwards the monthly PM_{2.5} datasets that have gone through AM validation checks to the Meteorology and Quality Assurance Section (MQA).

MQA is responsible for data review not specifically related to the operation of the PM_{2.5} sampler and may also review instrument sampling measurements to determine data validity.

Air Monitoring Data Review

PM_{2.5} data reviewers are the Air Monitoring Station Operators. Station Operators and Field Supervisors have the authority to edit data values and modify data validation and qualifier codes.

The Station Operator shall:

- Complete the 24-Hour-Field Sample Report form:
 - Include Sample Summary data and any codes generated by the instrument (Sampler codes).
 - If the ambient temperature sensor is reporting erroneous values, do not omit these values (MQA will assign a Qualifier code to the data).
 - Void the sample by circling only one Null Code (of the most importance) for any of the following reasons (see Appendix A – Null Code Guidance):
 - The sample is taken during periods of equipment malfunction, maintenance, or interference from other activities at the station.
 - The filter shows signs of contamination.
 - The filter appears to be defective before the run, or is dropped or damaged at any time.
 - Filter leakage.
 - If the sampler does not meet run time specifications, circle one Null Code (see Appendix A – Null Code Guidance) that indicates the most important reason for the failure. Sample time is out of limits if following two specifications are not met:
 - The total Elapsed Sampling Time (accounting for any power interruptions) must be within 1380 minutes (23 hours) to 1500 minutes (25 hours).
 - The start and stop times must be within 60 minutes (one hour) of midnight on the sampling date.
 - Note on the 24-Hour-Field Sample Report form any Exceptional Events that could have affected the sample (fire, construction, etc.), by circling as many Qualifier codes as appropriate.
 - Include an explanation in the Operators Comments sections if a Null Code or Qualifier circled.
 - If a Null Code is selected for a sample, schedule a date for a make-up sample that falls either before the next scheduled sampling date or exactly seven days after the original scheduled sample date (the make-up sample must occur within the same calendar quarter, and no more than five make-up samples are allowed per quarter). Make a note of the date of the make-up run in the Operators Comments section.

- If an Operations Data Action Monitoring Notification (ODAMN) is issued by the QA group, determine when the faulty condition started, if possible. Send an e-mail to the Laboratory Analyst and the Meteorology Supervisor indicating the data invalidation interval, starting at an identifiable failure or at the last good instrument check and ending with completion of corrective action.
- If a PM_{2.5} FRM instrument fails a QC leak or flow check, and affected filters and corresponding Chain of Custody forms have already been sent to the laboratory and cannot be annotated by the operator, send an e-mail to the Laboratory Analyst and the Meteorology Supervisor indicating the data invalidation interval, starting at an identifiable failure or at the last good instrument check and ending with the completion of corrective action.

Laboratory Data Review

The Laboratory Analyst conducts a secondary check of a PM_{2.5} sample's validity. The Laboratory also enters any Null or Qualifier codes into the District PM_{2.5} database.

The Laboratory Analyst shall:

- Complete the 24-Hour-Field Sample Report form. If the sample does not meet quality control standards for any of the following reasons, void the sample by circling the appropriate Null code on the form, with an explanation in the Lab Comments section (see Appendix A – Null Code Guidance):
 - The filter shows signs of damage or contamination that may have occurred during or after the sampling.
 - The filter was removed from the sampler more than 7 days and 9 hours (177 hrs.) after the start of sampling.
 - Post-weighing was not carried out within 30-days of the start of the sampling.
 - No dust load is found on the filter.
- For filters used for sampling after the 30-day expiration date enter qualifier “2” in the FlagMessage column in the weighing table of the PM_{2.5} Access database. Do not enter a Null Code.
- If the Laboratory determines that a sample should be voided and 7 days has not yet elapsed since the date of the sample, contact the Station operator as soon as possible, so that a make-up run can be arranged if feasible.
- Verify that the Agency, Filter Type, Weights, and Filter Validity are entered correctly in the PM_{2.5} Access database.
- Enter any Null or Qualifier codes indicated on the 24-Hour-Field Sample Report into the “Flag Message” column of the Weighing table in the PM_{2.5} Access database. Multiple code entries should be separated by commas.
- Enter Null Code “AG” to the PM_{2.5} Access database if the sample time is less than 1380 or more than 1500 minutes.
- Complete a report of voided filters each month (including filters with numeric qualifiers) and e-mail to the Director of Technical Services, Laboratory Manager, Air Monitoring Manager, and Meteorology Supervisor.
- Retrieve the Sample Summary information from each sample run and import the data to the District's PM_{2.5} Microsoft Access database in the network directory P:\Techdata\Tech\PM25\PM25.mdb.

- Review the completed 24-Hour-Field Sample Reports, checking for missing data, outliers, and errors during data entry.
- If there is no Null Code indicated but the sample time is out of limits, contact the station operator to select the most appropriate Null Code based on the underlying reason why the sample time was out of limits.
- Prepare monthly datasets of Primary and Collocated data in AQS format. Create an AQS record for any missing records for a scheduled sample date, using the appropriate Null code after consultation with the station operator. Check these datasets for integrity and forward to MQA. Also forward the file “PM25_Alert.txt” if it is generated by the data extraction program, which identifies any filters that fail certain Quality Assurance checks and require further scrutiny.

MQA Data Review

The MQA section maintains the computer program that extracts PM_{2.5} concentration data and QA parameters (sampling conditions metadata) from the PM_{2.5} Access database, formatted for submittal to AQS. The program performs the following functions that affect data output:

- In the event that the sample duration time is less than 1380 minutes (23 hours) but not less than 480 minutes (8 hours), an adjusted concentration is calculated [sample concentration * (actual duration in minutes/1440)]. If the adjusted concentration exceeds the NAAQS 24-hour Standard, the adjusted sample concentration (qualified with the code Y – Elapsed Sample Time Out of Spec.) is reported as valid (the Null Code is not included.)
- If the Concentration record is Null, no Qualifiers are output, and the QA parameters are not generated.
- Tests for the following conditions for each sample and prints the filter information to a QA warning file (PM25_Alert.txt) if they are met:
 - The concentration is less than 2 µg/m³.
 - The Sample Time TM flag exists for the sample, but there is no Null Code in the database (the program also assigns the Null code “AG” to the data record)
 - The Null code “AG” is present in the Weighing table of the database.
 - The Average Meter Drop is below 30 inches H₂O.
 - The Ambient Max Temperature is over 40 deg C.
 - The Flow Coefficient of Variation (Flow CV) is greater than 2%.

MQA staff conducts the final review of District PM_{2.5} data before uploading data into the EPA Air Quality System (AQS) database.

The MQA reviewer shall:

- Review Operations Data Action Monitoring Notifications (ODAMNs) issued by the QA group against PM_{2.5} samplers indicating a failed Quality Assurance audit. ODAMN documents are stored in the P:\Techdata\MQA\QA\ODAMN directory. Reviewer shall invalidate all data collected since the last valid leak/flow check until corrective action was completed by Air Monitoring. If, in consultation with Air Monitoring, a definable moment can be identified when the PM_{2.5} sampler failure

occurred after the last leak/flow check, data invalidation may begin at the time of failure.

- Examine the data each month for completeness and to ensure that the values appear reasonable. The data are compared spatially, and may be compared to historical data, PM₁₀ data, and meteorological conditions. Excessively high or low values and anomalies are investigated and resolved.
- Investigate all data records with Null codes (see Appendix A – Null Code Guidance) or Qualifiers for authenticity.
- If the sample has any qualifier associated with it, inspect the data to be sure that it looks reasonable before submitting to AQS.
- Review entries in the QA warning file (PM25_Alert.txt) generated by the PM_{2.5} data extraction program, investigating and resolving problems that may affect data validity.
- Void the sample if the associated Flow CV is > 2.49%, using the “AH” Null Code.
- If the sampler’s ambient temperature sensor is not working correctly and reporting erroneous values, the PM_{2.5} filter sample is not voided for this reason, and the following procedures apply:
 - If value for the ambient average temperature (parameter code 68105) is less than -40 °C or greater than 50 °C, then the “AN” Null Code (Machine Malfunction) shall be used, rather than the value.
 - Values for the ambient average temperature records from -40 to 50 °C (inclusive) shall be submitted to AQS as reported by the instrument but qualified with an “X” Qualifier code (Filter Temperature Difference Out of Spec.).
 - Whenever the “X” Qualifier or “AN” Null Codes are submitted for ambient average temperature, the associated Sample Concentration record (parameter code 88101) shall also include the “X” Qualifier.
- Compare Collocated PM_{2.5} data to Primary PM_{2.5} data, to determine if the data is reasonably close and unbiased.
- Report any samples voided by MQA or other problems to the Laboratory, Air Monitoring Manager, and Quality Assurance Officer.
- Complete review and posting of PM_{2.5} data to AQS no later than 75 days after the end of the month.

Appendix A – Null Code Guidance

Guidance for use of Null Codes when a PM2.5 sample is voided

For the following circumstances, the suggested Null Codes should normally be used. There may be rare situations when a different Null code would be more suitable. This is not an exhaustive list of either possible circumstances or Null Codes.

Sample pressure out of limits	AA
Technician unavailable	AB
Sample not run due to construction near site	AC
Shelter storm damage	AD
Shelter temperature out of limits	AE
Sample time out of limits	AG
Flow rate out of limits	AH
Flow CV > 2.49%	AH
Insufficient Data (cannot calculate)	AI
Filter damage	AJ
Filter leak	AK
Miscellaneous void	AM
Equipment malfunction	AN
Sample not run due to bad weather	AO
Vandalism	AP
Lab received sample too late for post-weighing within 30 days of sample start time	AQ
Post-weighing more than 30 days from start of the sampling (lab error)	AR
Sample voided due to lab error	AR
Filter dropped at lab	AR
Filter contamination, cause unknown	AS
No dust load found on filter; no other problems found with run	AS
QC check/calibration causing elapsed time to be out of limits	AT
Power failure causing elapsed time to be out of limits	AV
Wildlife damage	AW
QA Audit causing elapsed time to be out of limits	AZ
Equipment maintenance/repair (except QC check) causing the sample to be voided	BA
Technician unable to reach site	BB
Sampling not possible due to building/site repair or construction	BE
Lost or damaged sample during transit	BI
Sample voided due to operator error or missed sample day	BJ
Sample voided or run missed due to programming error	BJ
Filter dropped at monitoring site	BJ
Filter was used for sampling after the 30-day expiration date	BJ
Filter removed from sampler more than 177 hours after start time	BJ
Holding Time or Transport Temperature is Out of Specs.	TS
Post-weighing more than 30 days from start of the sampling	TS

Authors, Revisions, and Approvals

December 2006 (original)

June 2007 (revision: changed procedures for Lab regarding filters for which no dust load was found and filters used after the expiration date; stated in Station Operator section stating that sample start/stop times be within one hour of midnight)

November 2007 (revision: changed procedures for Lab regarding filters for which no dust load was found and filters used after the expiration date; added Appendix A – Null Code Guidance)

February 2008 (revision: changed procedures for MQA regarding sample runs with a Flow CV greater than 2.49%)

June 2008 (revision: clarified procedures for MQA regarding filters used after the expiration date)

August 2011 (revision changed procedures for Lab and MQA regarding filters used after the expiration date and updated Appendix A – Null Code Guidance).

July 2012 (revision: removed reference to AQIS responsibility, removed requirement to copy Accuracy data into the PM2.5 Access Database, updated Appendix A – Null Code Guidance)

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Approved: James Hesson, Laboratory Manager

References

EPA Quality Assurance Guidance Document 2.12 - Monitoring PM2.5 in Ambient Air Using Designated Reference or Class I Equivalent Methods

CARB Air Monitoring Quality Assurance Manual Vol. II, [Appendix AI - Andersen RAAS2.5-300 Sequential Air Sampler](#)

40 CFR Part 50-National Primary and Secondary Ambient Air Quality Standards, Appendix L-[Reference Method for the Determination of Particulate Matter as PM_{2.5}](#) in the Atmosphere

Scheffe, Richard G., June 15, 2000 Memorandum: [Flagging and Valid PM_{2.5} Data](#)