



TECHNICAL SERVICES DIVISION
QUALITY ASSURANCE PROJECT PLAN

DATA MGT SOP 605
AETHALOMETER

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STANDARD OPERATING PROCEDURE
BAAQMD Technical Services Division

**PM_{2.5} Black Carbon Magee Scientific Aethalometer™ Data
Management**

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Table of Contents

Purpose..... 2
Background..... 2
Procedure Summary..... 2
Air Monitoring Data Review 3
MQA Data Review 4
Authors, Revisions, and Approvals 5
References..... 5
Footnotes..... 5

Purpose

The purpose of this Data Management Standard Operating Procedure (SOP) is to document data validation procedures for Magee Scientific Aethalometer™ Monitors (Model AE-16) used by BAAQMD to measure continuous PM_{2.5} Black Carbon 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 several Magee Scientific Aethalometer™ monitors to measure continuous ambient PM_{2.5} BC (Black Carbon) mass concentrations. There is no EPA reference method for PM_{2.5} BC, but the Aethalometer is the required monitoring instrument for the National Ambient Air Toxics Trends and Assessment Program (NATTS). These data are submitted to the Air Quality System (AQS).

Procedure Summary

Data review begins with the Air Monitoring (AM) Section staff that operates and maintains Aethalometer instruments. AM is responsible for following approved Aethalometer instrument SOPs and is the final authority in determining whether the Aethalometer is operating correctly and thus providing valid data. When a digital data collection system is available for the Aethalometer, Aethalometer metadata (information about how the instrument is operating) shall be reviewed by AM to assist in the data validation process.

A second data review is conducted by the Meteorology and Quality Assurance Section (MQA). In general, MQA is responsible for all data review not specifically related to Aethalometer instrument operation. As part of the Quality Assurance function, MQA may recommend changes concerning AM data handling and validation procedures. These changes would require agreement by the Technical Division Director and, depending on the scope, may require Quality Assurance Program Plan approval by CARB and EPA.

Air Monitoring Data Review

Aethalometer data reviewers include the Air Monitoring Station Operator, Field Supervisor, and the Data Assessment Air Quality Instrument Specialist (AQIS). Station Operators and Field Supervisors have the authority to edit data values and modify data validation codes.

Station Operator

The Station Operator shall:

- Ensure that Aethalometer is set up to calculate flow using volumetric flow units at standard temperature of 25° C and pressure of 1013 millibars
- Review Aethalometer operational data on a daily basis to confirm normal instrument operation
- Invalidate all data recorded during periods of equipment malfunction, maintenance, or interference from other activities at the station
- Investigate any data associated with an error message or error light
- Invalidate data in accordance with Air Monitoring QA procedures if the sample flow on the Aethalometer display is outside of the range of $\pm 7\%$ from the sample flow rate setting¹
- Invalidate data in accordance with Air Monitoring QA procedures after failing a periodic AM flow check² or leak check³
- Invalidate data in accordance with Air Monitoring QA procedures when the indicated flow rate of the Aethalometer does not agree within 7% of an Audit Flow Standard⁴, or fails an Audit leak check or dynamic zero check³.
- Invalidate data when the ambient temperature was greater than manufacturer's recommended specification of a maximum of 40°C⁵
- Notify MQA immediately of any changes in Aethalometer equipment or associated datalogger/telemetry changes or adjustments
- Complete all Aethalometer data review no later than 7 days after the end of the month

Field Supervisor

The Supervisor shall:

- Review all data modifications and validation code changes made by Station Operators
- Provide for uniform Station Operator reviews throughout the District

- Complete all Aethalometer data review no later than 21 days after the end of the month

Data Assessment AQIS

The Data Assessment (AQIS) shall:

- Check for data irregularities and suspicious values and refer problems back to Station Operators or Supervisors
- Check for inconsistent data review between stations and refer problems back to Supervisors for resolution
- Examine all Air Monitoring Chain-of-Custody log records documenting data adjustments and invalidations. Confirm that all changes include a reason for the change and identifies the responsible person.
- Identify the specific Aethalometer data corrections to be made by the Data Editor
- Complete all Aethalometer data review no later than 45 days after the end the month.

Data Editor

The Technical Division secretary shall make Aethalometer data corrections identified by the Data Assessment AQIS. Corrections shall be finished no later than 60 days after the end the month.

MQA Data Review

A member of the Meteorology/Quality Assurance staff conducts the final review of District Aethalometer data before uploading data into the EPA Air Quality System (AQS) database.

The MQA reviewer shall:

- Confirm that corrections made by the Data Editor are consistent with Daily Summary Report notations provided by Air Monitoring
- Review ODAMNs (Operations Data Action Monitoring Notification) issued against Aethalometer instruments indicating a failed QA audit and resulting in data invalidation. ODAMN documents are stored in the \QA network directory
- Review and concur with Air Monitoring data invalidation resulting from failure of regular failed AM leak and flow checks
- Post-process the raw data as necessary, which includes examining the Aethalometer flow rate in raw instrument data files (and invalidating data associated with a flow rate that exceeds $\pm 7\%$ of the desired flow rate), and using the “AethDataMasher” program to reformat the raw data files, performing certain data validation checks
- Examine the data to ensure that the values appear reasonable. Both the 5-minute and hourly-average output files should be reviewed in a spreadsheet or graphics package, and the BC data plotted as a time series to further check the integrity of the data. The data are compared spatially, and may be compared to historical data and meteorological conditions.

- Ensure that any adjustment to 5-minute data be compensated for in the 1-hour average data, observing the data completeness requirement of 75%.
- Compare hourly trends to neighboring Aethalometer or BAM_{2.5} values through the network, recognizing that the BAM may not react similarly to BC. Excessively high values and anomalies are investigated and resolved.
- Review the data for excessive noise
- Review the data for excessive, consecutive periods of negative values.
- Investigate excessive rate-of-change occurrences to determine if meteorological changes or a local (temporary) source could support a rapid change in BC loading.
- Examine Chain-of-custody log records documenting data adjustments and invalidations. Excessive data validation problems with a particular instrument or site could indicate a siting or inlet placement too close to an aerosol BC source
- Report any problems to the Air Monitoring and QA Managers
- As necessary, convert the finalized 1-hour average data to an AQS compatible format. Complete posting of hourly Aethalometer data to AQS no later than 75 days after the end of the month

Authors, Revisions, and Approvals

April 2005 (original version)

Author: Ken Crysler, AQ Meteorologist

Author: Mark Stoelting, Principal Air and Met Monitoring Specialist

Approved: Dick Duker, Meteorology and Quality Assurance Manager

Approved: Eric Stevenson, Air Monitoring Manager

References

[DRAFT EPA Technical Assistance Document for the National Ambient Air Toxics Trends and Assessment Program \(2003\)](#), Section 4.6

[Care and Feeding of Aethalometers™ Model AE16 and AE21](#) (George Allen [2003])

[User Guide for the WUAQL AethDataMasher \(version 4.2g\)](#)

[Magee Scientific Aethalometer™ User Manual \(2003.04\)](#)

Footnotes

¹ It is District policy that if the sample flow is outside of the range of $\pm 7\%$ from the sample flow rate setting, the data should be invalidated back to the time of the last known acceptable sample flow (logged flow or flow check).

² It is District policy that if the difference between the result of an external flow check (by AM) and the flow indicated by the Aethalometer display is greater than 7%, the data should be invalidated back to the time of the previous passing flow check.

³ It is District policy that if a leak check or dynamic flow check fails, the data should be invalidated back to the time of the last good leak check or dynamic zero check

⁴ It is District policy that if the difference between the result of the Audit Flow Standard and the flow indicated by the Aethalometer display is greater than 7%, the data should be invalidated back to the time of the previous passing flow check.

⁵ It is District policy to invalidate data recorded while the Aethalometer was operating when the ambient temperature was greater than 40°C (manufacturer's recommended specification).