CALIFORNIA
AIR RESOURCES BOARD

Performance Audit Procedures
For Met One
Speciation Air Sampling System (SASS) Monitors

Volume V
Audit Procedures Manual for Air Quality Monitoring

QMB SOP Appendix AT
Revision 0

Quality Assurance Section
Quality Management Branch
Monitoring and Laboratory Division

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Disclaimer: Mention of any trade name or commercial product in this standard operating procedure does not constitute endorsement or recommendation of this product by the California Air Resources Board. Specific brand names and instrument descriptions listed in the standard operating procedure are for equipment used by the California Air Resources Board's Quality Assurance Section. Any functionally equivalent instrumentation is acceptable.

PERFORMANCE AUDIT PROCEDURES
FOR MET ONE SPECIATION AIR SAMPLING SYSTEM (SASS) MONITORS

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ACRONYMS AND DEFINITIONS

Acronym	Definition
AIS	Audit Information System
AQS	Air Quality System (U.S. EPA database)
AT	Ambient (Outdoor) Temperature
BP	Barometric Pressure
°C	Degrees Celsius
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CSN	Chemical Speciation Network
FEM	Federal Equivalent Method
FRM	Federal Reference Method
lpm	Liters Per Minute
LC	Local Conditions
µm	Micron (or Micrometer)
mm	Millimeter
mmHg	Millimeter of Mercury
NIST	National Institute of Standards and Technology
PM	Particulate Matter
PMc	Particulate matter between 10 and 2.5 microns in diameter
PM_{10}	Particulate matter 10 microns or less in diameter
$PM_{2.5}$	Particulate matter 2.5 microns or less in diameter
QA	Quality Assurance
QAS	Quality Assurance Section
QC	Quality Control
Q_a	Flow Rate at Actual (ambient) Conditions
Q_s	Flow Rate at Standard Conditions
SASS	Speciation Air Sampling System
SCC	Sharp Cut Cyclone
SOP	Standard Operating Procedure
U.S. EPA	United States Environmental Protection Agency

AT.1.0 INTRODUCTION

The California Air Resources Board's (CARB) Quality Assurance Section (QAS) is responsible for conducting independent assessments or performance evaluations (or audits) on particulate matter (PM) monitors generating data for regulatory and other purposes. In accordance with guidelines and federal requirements outlined in 40 CFR Part 58, Appendix A, "Quality Assurance Requirements for Monitors used in Evaluations of National Ambient Air Quality Standards", QAS also conducts annual audits of non-criteria parameters, including chemical speciation and meteorological monitors.

The audit procedures presented in this Standard Operating Procedure (SOP) pertain specifically to Speciation Air Sampling System (SASS) monitors operating in the California ambient air monitoring network, including the standard SASS, SuperSASS and SASS 22L models. All models are trademarks of Met One Instruments, Inc. and are collectively referred to as SASS monitors. These monitors collect samples for the chemical and gravimetric analysis of particulate matter with a diameter of 2.5 microns (µm) or smaller ($PM_{2.5}$) in ambient air. $PM_{2.5}$ is comprised of sulfates, nitrates, organic carbon, soot-like carbon and metals, and is speciated after collection on a filter medium. More information about the United States Environmental Protection Agency (U.S. EPA) $PM_{2.5}$ Chemical Speciation Network (CSN) can be found here: https://www.epa.gov/amtic/chemical-speciation-network-csn.

AT.2.0 SUMMARY OF METHOD

The Met One SASS utilizes up to five independent channels (or eight channels in a SuperSASS), each with a sharp cut cyclone (SCC) attached directly to a filter canister, that are arrayed in a raised carousel (see Figure AT.1). The canisters are mounted in a wind aspirated radiation shield that maintains sampler temperature close to ambient. Inlets point downward and the sample flow rate is 6.7, 6.9, or 22.0 liters per minute (lpm) for each canister. The $PM_{2.5}$ separation is produced by the SCC that removes both solid and liquid coarse particles with equal efficiency without the use of impaction grease or oil. Speciation analysis is dependent on the type of filter media used in each canister.

An accurate measurement of PM speciation is dependent on the flow rate through the sample inlet cut point, which dictates the size fraction of

PM collected. Therefore, the proper operation of a SASS is determined by comparing the sampler's volumetric flow rate through the cut point to a certified audit flow standard. Additionally, the flow rate can be compared to the ideal flow rate (design) based on the manufacturer's specifications. Other variables such as ambient temperature (AT), barometric pressure (BP), and filter temperature are also evaluated against an audit standard. A leak check of the sample train is also performed. The results of the audit determine whether the sampler responses are maintained within acceptable criteria, and help produce reliable ambient PM speciation data.

An accuracy assessment of SASS monitors can be achieved by conducting an audit under the following guidelines:

1. Without special preparation or adjustment of the system to be audited.
2. By individuals with a thorough knowledge of the instrument or process being evaluated, but not by the routine operator.
3. With standards traceable to the National Institute of Standards and Technology (NIST) that are completely independent of those used in routine calibration/verification. They can be traceable to the same primary standard.
4. With complete documentation of audit data summarized in a report for submission to the operating agency. Audit data includes, but is not limited to: types of instruments and audit transfer standards, model and serial numbers, transfer standard traceability, calibration information, and collected audit data.

An independent observer should be present, preferably the routine operator of the sampling equipment. This practice not only contributes to the integrity of the audit, but also allows the operator to offer any explanations and information that will help the auditor to determine the cause of discrepancies between measured audit data and the sampling equipment response.

Figure AT.1: Photo of SASS monitor including vacuum pump box

AT.3.0 INTERFERENCES

The interferences associated with this method mainly include factors that can alter the flow through the sampler's SCC, the audit canister, or audit standard. Lower than expected flow rates can be the result of a leak, which may be caused by improper installation of the audit flow standard. Also, the flow rate is dependent on an accurate measurement of AT and BP.

- Audit standards should be warmed up and operating under ambient conditions. If temperature or pressure values are fluctuating, the audit should not be conducted until values are relatively stable.
- Take precautions against altering the normal operating conditions of the sample train, and prevent air flow leaks during the audit.

AT.4.0 PERSONNEL QUALIFICATIONS

All new CARB auditors undertake a one-year training program that is documented and monitored by the QAS manager. The training includes in-office reading and coursework, hands-on field experience conducting audits, and shadowing an experienced auditor for one year along with several in-field evaluations by the QAS manager. U.S. EPA reviews CARB's training program regularly for approval as an equivalent to U.S. EPA's national certification and recertification courses. Auditors should be familiar with the regulations and guidance cited in the references section (AT.10.0) prior to conducting any audits without supervision. Each auditor is expected to have a minimum level of on-the-job training and familiarity with the audit equipment prior to conducting the audit(s).

The U.S. EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program (January 2017) should be considered as required reading prior to conducting audits. Additionally, auditors should be familiar with the Field Operation Manual for Met One SASS and SuperSASS models found here: https://metone.com/wp-content/uploads/2019/10/SASS-9800-Rev-J.pdf

NOTE: A station operator familiar with the equipment should also be present during the entire audit to perform the necessary operation of

station equipment, as needed. Auditors should check for proper operating conditions, verify values and readings, and record audit data without changing the normal configuration of station equipment.

AT.5.0 HEALTH, SAFETY, AND CAUTIONS

All personnel must follow any general health and safety guidelines as described by the facility where the audit is conducted. All audit equipment, including audit vehicles, should be used only for the purpose and in the manner described in this SOP and in the appropriate operator's manual. Falls from portable ladders are one of the leading causes of occupational fatalities and injuries. Appropriate safety precautions should be taken and auditors should be familiar with, and trained on, proper ladder usage. Care should be taken when accessing instruments, especially on station rooftops. All equipment being audited should be easily and safely accessible.

AT.6.0 EQUIPMENT AND SUPPLIES

All audit standards must be certified against a primary standard traceable to NIST. Audit equipment for flow rate, temperature and BP must not be the same as that equipment used for routine site verifications and/or calibrations, but can be traceable to the same primary standard.

Prior to departing for an audit, it is necessary to confirm that the audit equipment is in working order and the most recent worksheets are available. Information recorded during an audit includes, but is not limited to, sampler and audit transfer standard type, model and serial numbers, transfer standard traceability and calibration information, AT and BP conditions, maintenance schedules and dates, and collected audit values.

Performance audits for SASS monitors require the following equipment:

- Calibrated and certified audit flow standard capable of measuring the appropriate volumetric flow rates (6.7 to 22.0 lpm). The flow device should be within ±2% of a NIST-traceable standard, and certified on an annual basis.
- A thermometer or thermistor capable of accurately measuring temperature in the range of -20°C to +60°C with a resolution of

±0.1°C. It must be referenced to a NIST thermometer and be certified annually. The thermometer should be within ±0.5°C of the NIST-traceable thermometer on the annual check.
- A barometer capable of accurately measuring ambient pressures to the nearest millimeter of mercury (mmHg) in the range of 500 to 800 mmHg. The barometer must be within ±5 mmHg of a barometer traceable to NIST at least annually.
- Cell phone, or access to the time.gov internet site (for clock checks). Use Pacific Standard Time, not Daylight Savings Time.
- SASS audit canisters, each with one of three filter types: Teflon®, quartz, or nylon filters. Audit canisters should be pre-configured and ready for field use. Refer to section AT.6.1 for more details.
- Audit worksheet for SASS monitors.
- Computer or tablet with access to the Audit Information System (AIS) audit software for data entry and report generation.

NOTE: The sharp cut cyclones used during the audit are those normally used with the SASS monitor being evaluated, and are provided by the operator.

AT.6.1 SASS CANISTERS

The integrated sampler canister is shown below in Figure AT.2: Disassembled SASS canister, including sharp cut cyclone. The photo shows the following components:

- Sharp cut cyclone to remove particles larger than 2.5 µm aerodynamic diameter.
- Denuder (used with a nylon filter) to remove nitric acid or other interfering gases, or an empty denuder ring.
- 47mm front filter for particle capture.
- 47mm tandem or Backup filter, as needed.
- Cover to hold and protect the components

An empty denuder sleeve is used when no denuder is needed. If only one filter is used, it is placed in the front filter position, with the second filter holder being empty. Assembly details are shown in the Operation Manual mentioned in section AT.4.0.

The correct filter configuration should be used when auditing to simulate conditions used during sampling. SASS samplers operated by CARB typically might have canisters configured as follows (be sure to confirm channels, filter types, and set flow rates with the site operator):

- Channel/Canister 1 containing a Teflon® filter (operating at 6.7 lpm)
- Channel/Canister 2 containing a denuder and a nylon filter (operating at 6.7 lpm)
- Channel/Canister 3 containing a Teflon® filter (operating at 6.7 lpm)
- Channel/Canister 4 containing a quartz filter (operating at 22.0 lpm)
- Channel 5 (typically not in use) configured to operate at 6.9 lpm

Figure AT.2: Disassembled SASS canister, including sharp cut cyclone

AT.7.0 AUDIT PROCEDURES

Begin the audit by observing the equipment to be audited and its current configuration. Consult with the operator prior to navigating through display screens or making changes to the station equipment. Whenever possible, the operator should perform the functions while the auditor observes and directs the audit procedures. Should it be unavoidable to complete the audit on a sample or run day, the operator must prepare the sampler for the audit and return it to the desired

sampling frequency after the audit. Do not conduct an audit while the SASS is sampling or interrupt sampling.

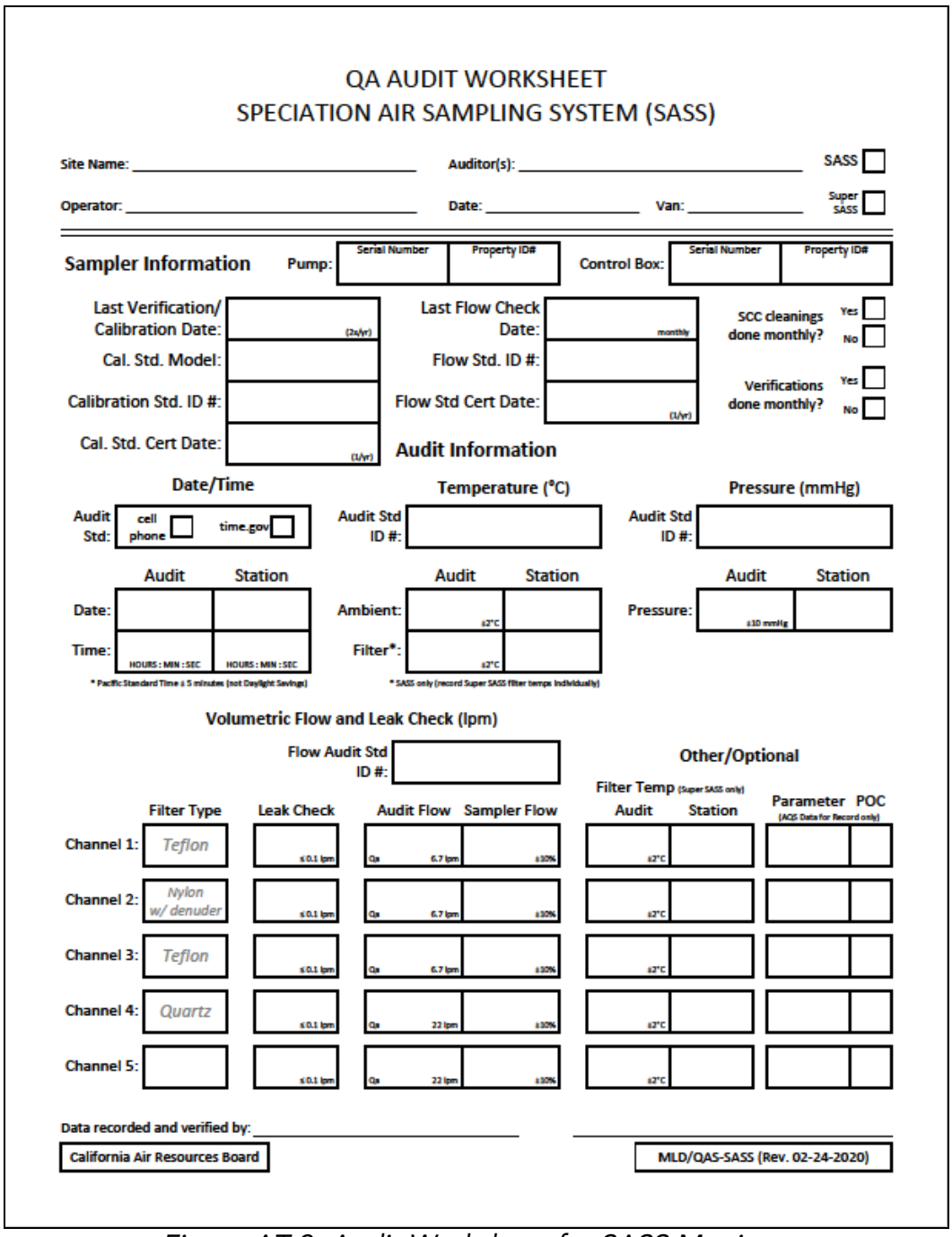
Allow the audit standards to warm up and equilibrate in accordance with manufacturers' recommendations. This is normally achieved by placing the audit standards within reach of the sampling inlet and exposed to ambient conditions, but not in direct sun. During the course of an audit, conditions such as temperature and pressure can vary and potentially influence the assessment results. As such, it is advisable to collect these measurements from the audit devices and sampler sequentially within as short a time interval as practically possible.

NOTE: When removing the canisters, keep them in their normal operating position and remove the sharp cut cyclone. Do not invert the canister when removing the SCC, as any loose material in the cyclone might fall into the canister and contaminate the collection filter.

Procedures listed in the following subsections are recommended to be performed in the order presented. While waiting for equilibration or stabilization of equipment, begin to record information onto the worksheet (Figure AT.3), which includes audit values and other data:

- Site name, audit date, site operator, auditor(s).
- Audit standard information.
- Calibration information.
- Monthly maintenance information, including flow and leak checks.
- SASS channel information, including canister filter types and design flow rates for channels in operation.
- Information from the U.S. EPA Air Quality System (AQS).

Refer to section AT.8.0 for details on data entry and management of records.



QA AUDIT WORKSHEET
SPECIATION AIR SAMPLING SYSTEM (SASS)

Site Name: _____ Auditor(s): _____ SASS ☐

Operator: _____ Date: _____ Van: _____ Super SASS ☐

Sampler Information Pump: Serial Number | Property ID# Control Box: Serial Number | Property ID#

Last Verification/ Calibration Date: (2x/yr)
Cal. Std. Model:
Calibration Std. ID #:
Cal. Std. Cert Date: (1/yr)

Last Flow Check Date: monthly
Flow Std. ID #:
Flow Std Cert Date: (1/yr)

SCC cleanings done monthly? Yes ☐ No ☐

Verifications done monthly? Yes ☐ No ☐

Audit Information

Date/Time

Audit Std: cell phone ☐ time.gov ☐

Audit Std ID #:

Temperature (°C)

Audit Std ID #:

Pressure (mmHg)

	Audit	Station
Date:		
Time:	HOURS : MIN : SEC	HOURS : MIN : SEC

* Pacific Standard Time ± 5 minutes (not Daylight Savings)

	Audit	Station
Ambient:	±2°C	
Filter*:	±2°C	

* SASS only (record Super SASS filter temps individually)

	Audit	Station
Pressure:	±10 mmHg	

Volumetric Flow and Leak Check (lpm)

Flow Audit Std ID #:

	Filter Type	Leak Check	Audit Flow	Sampler Flow	Other/Optional: Filter Temp (Super SASS only) Audit	Filter Temp (Super SASS only) Station	Parameter (AQS Data for Record only)	POC
Channel 1:	Teflon	≤0.1 lpm	Qa 6.7 lpm	±10%	±2°C			
Channel 2:	Nylon w/ denuder	≤0.1 lpm	Qa 6.7 lpm	±10%	±2°C			
Channel 3:	Teflon	≤0.1 lpm	Qa 6.7 lpm	±10%	±2°C			
Channel 4:	Quartz	≤0.1 lpm	Qa 22 lpm	±10%	±2°C			
Channel 5:		≤0.1 lpm	Qa 22 lpm	±10%	±2°C			

Data recorded and verified by: _____ _____

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Figure AT.3: Audit Worksheet for SASS Monitors

AT.7.1 CLOCK AND LEAK CHECKS

- Open the control box and press any key to awaken the screen.
- Press “Event”.
- Press “F1” Current Event Status.
- Note the current status (NOTE: QA audits should NOT be conducted during a sampling sequence).
- Press “Exit” twice.
- Lower the radiation shield.
- Have the operator remove the sample canisters and SCCs from the operational SASS channels, if necessary. (NOTE: Be sure each component is marked in some way to identify its channel). The canister’s sample port should be capped and set aside, keeping the canister in an upright position.
- Attach a properly configured quality assurance audit canister and the channel’s SCC to the inlet of the channel being audited.
- Press “Calibrate”.
- Press [F1] to access the “System Test” screen.
- Press “Pump” and “Continue”. The screen should return to the System Test Menu, and the pump should turn on.
- Allow pump to stabilize (approximately 5 minutes).
- Record the date and time from the System Test screen and audit standard (a cell phone or time.gov) onto the Audit Worksheet. The sampler should be set to Pacific Standard Time (not Daylight Savings Time).
- Press “Leak”. The leak test module turns off the motor control to the flow controller valves.
- Tightly seal the inlet of the SCC using a cap or a non-gloved thumb.
- Allow for stabilization (NOTE: The flow rate for each channel should drop to 0.1 lpm or less).
- Slowly release the vacuum and record the leak flow rate from the System Test menu screen onto the audit worksheet.
- Without making changes to the operating status of the SASS (i.e., it is not necessary to turn the pump or leak check mode off when

switching channels), repeat the leak check on the other channels using the correct audit canister and the corresponding SCC.

- When the leak flow value for all channels has been recorded, Press "Leak". This will turn off the leak check mode.

AT.7.2 TEMPERATURE AND PRESSURE AUDITS

- To check ambient temperature, place the probe of the audit temperature standard into the radiation shield of the SASS temperature sensor.
- NOTE: If the SASS model being audited has "filter temperature" values, the monitor has independent sensors for each channel, which must be checked individually. In these cases, insert the audit temperature probe into the inlet of each individual channel. This is the location of the temperature sensors.
- Avoid direct contact with the sides of the grill or direct contact with sunlight. Allow for stabilization. When the temperature values are stable, record the temperature standard's value and the ambient temperature (or individual filter temperature) value(s) from the SASS displayed on the upper right-hand corner of the System Test screen.
- For barometric pressure, read and record the audit pressure standard's value and the pressure value from the SASS, again, located in the upper right corner of the System Test screen.

AT.7.3 SAMPLE FLOW RATE AUDITS

- With an audit canister attached to the sampler's SCC in place, attach a certified flow transfer standard (such as a TetraCal®) with tubing to the SCC on the channel being audited.
- Allow for stabilization of the flow, then record the flow reading (Qa) from the audit standard and sampler's channel flow rate.
- Without making changes to the operating status of the SASS, repeat the flow audit on the other active channels using the corresponding quality assurance canister. NOTE: Channel #4 may

have a design value of 22 lpm and require changing the audit flow standard's orifice.

- After all channel flow checks have been completed, press "pump" and "continue" to turn off the SASS pump.
- Remove the audit canisters and flow transfer standard.
- Have the operator replace the sample canisters to their original positions. Double-check their placement by verifying the identifying mark(s) on the sample canisters to the sample inlets and SCCs.
- Raise and secure the radiation shield.
- Press "EXIT" twice to return to the main menu screen.
- Close the control box.
- Obtain information from the site operator and/or logbook such as sampler documentation, cleaning schedule and dates, and verification/calibration information. Cleaning of the SCC should be done at least monthly. Verification and/or calibration of the temperature sensors, pressure sensor, and volumetric flow controller should be performed on a semi-annual basis, or per the applicable Standard Operating Procedure.
- Enter all data from the QA Worksheet into the Audit Information System, including any comments or action items, and generate a Preliminary Audit Report (refer to Section AT.8.2). Note any warnings or failures and notify the site operator accordingly.

See Table AT.1 for Control and Warning limits. If any parameters are outside the specified criteria, the Quality Assurance Section will make a recommendation to investigate data validity. Upon investigation, the release, invalidation, or correction of all data from the last calibration forward or known date of change (to be determined by the reporting agency) may result.

AT.7.4 TROUBLESHOOTING

If the audited flow rate or leak check exceeds the control or warning limits listed in Table AT.1, auditors should perform troubleshooting steps before recording data on the audit worksheet.

- Be sure equipment is equilibrated to ambient temperature and pressure conditions. If conditions have changed since the equipment was turned on, it may be necessary to power-cycle the audit equipment.
- Ensure there is no flow through the audit equipment during its start-up. Keep audit equipment out of the wind during start-up.
- Ensure O-rings on the flow audit standard head or orifice are in good condition and tubing (if applicable) fits snuggly without kinks or leaks.
- For leak checks, ensure the SCC inlet is completely sealed.
- For clock checks, be sure Pacific Standard Time is being used.

AT.8.0 DATA MANAGEMENT AND RECORDS

Always use the most recent audit worksheets, which are available on QA audit laptops and in the Cabinet (S:\Cabinet\Forms & Worksheets). Worksheets should be filled out carefully, using ink (no pencil) with legible characters and numbers. There should be no erasures, alterations, or correction fluid. Errors should be crossed-out with a single line, dated and initialed. Notes should be made on any exceptional events or conditions that may have an effect on the data, the equipment, or routine operation of the sampler during the audit. Audit worksheets and Preliminary Audit Reports will be reviewed by a minimum of two people, including management, before finalization of the audit.

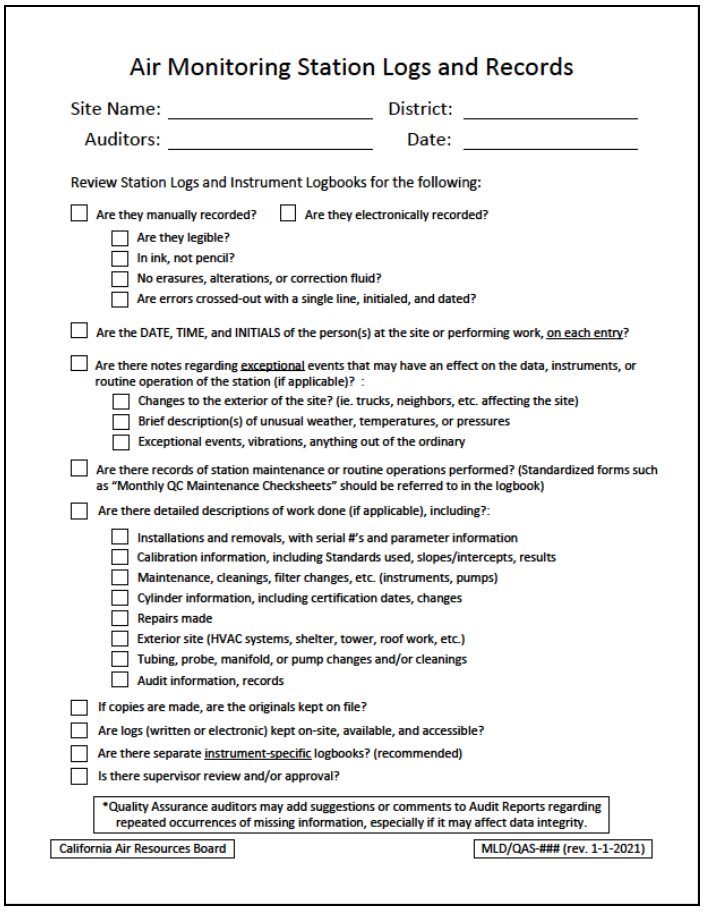
AT.8.1 GENERAL AUDIT PROCEDURES

1. Review the Audit Worksheet for completeness and accuracy, then sign it. Verify that all audit steps are complete.

2. Input data from the Audit Worksheet into AIS to generate results and a preliminary report. Review AIS for any questions or data that is not on the worksheets (such as verification of the most recent AQS information). The second auditor (if present) should review and verify that the Audit Worksheet and AIS entries match.

3. Station maintenance records and logbooks should be reviewed for missing audit data and completeness. A checklist has been developed

to assist in the review of station logs and records (see Figure AT.4). While not required, it should be used to identify any deficiencies, especially in the past six months, which should be documented as a "Comment" or "Action Item" in the Audit Report.



Air Monitoring Station Logs and Records

Site Name: _____ District: _____

Auditors: _____ Date: _____

Review Station Logs and Instrument Logbooks for the following:

- ☐ Are they manually recorded? ☐ Are they electronically recorded?
  - ☐ Are they legible?
  - ☐ In ink, not pencil?
  - ☐ No erasures, alterations, or correction fluid?
  - ☐ Are errors crossed-out with a single line, initialed, and dated?
- ☐ Are the DATE, TIME, and INITIALS of the person(s) at the site or performing work, on each entry?
- ☐ Are there notes regarding exceptional events that may have an effect on the data, instruments, or routine operation of the station (if applicable)? :
  - ☐ Changes to the exterior of the site? (ie. trucks, neighbors, etc. affecting the site)
  - ☐ Brief description(s) of unusual weather, temperatures, or pressures
  - ☐ Exceptional events, vibrations, anything out of the ordinary
- ☐ Are there records of station maintenance or routine operations performed? (Standardized forms such as "Monthly QC Maintenance Checksheets" should be referred to in the logbook)
- ☐ Are there detailed descriptions of work done (if applicable), including?:
  - ☐ Installations and removals, with serial #'s and parameter information
  - ☐ Calibration information, including Standards used, slopes/intercepts, results
  - ☐ Maintenance, cleanings, filter changes, etc. (instruments, pumps)
  - ☐ Cylinder information, including certification dates, changes
  - ☐ Repairs made
  - ☐ Exterior site (HVAC systems, shelter, tower, roof work, etc.)
  - ☐ Tubing, probe, manifold, or pump changes and/or cleanings
  - ☐ Audit information, records
- ☐ If copies are made, are the originals kept on file?
- ☐ Are logs (written or electronic) kept on-site, available, and accessible?
- ☐ Are there separate instrument-specific logbooks? (recommended)
- ☐ Is there supervisor review and/or approval?

*Quality Assurance auditors may add suggestions or comments to Audit Reports regarding repeated occurrences of missing information, especially if it may affect data integrity.

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Figure AT.4: Air Monitoring Station Logs and Records Checklist

4. See Section AT.9.2 for audit limits and criteria.

   NOTE: It is highly recommended to repeat or troubleshoot a procedure to confirm results that exceed audit criteria.

5. Notify the operator of preliminary audit results and any necessary follow-up actions. Forward a copy of the preliminary report to the operator and/or their supervisor upon returning from the field.

AT.8.2 AUDIT INFORMATION SYSTEM

The Audit Information System is used by QAS to manage data and site information collected during performance evaluations of air monitoring stations throughout the state. More information can be found in the Quality Assurance Manual, Volume V, Appendix AK: *Using the Audit Information System* (Refer to References; Section AT.10.0). Audits of SASS monitors should be entered into AIS using the SASS module.

AT.8.3 U.S. EPA AIR QUALITY SYSTEM

The U.S. EPA maintains a database for air monitoring data commonly called AQS (previously known as AIRS). The AQS parameters and associated methods relevant to audits of speciated PM monitoring can be found here: https://aqs.epa.gov/aqsweb/documents/codetables/methods_speciation.html

If SASS monitor data is being reported to AQS, it should be displayed on the audit dossier for each site, generated by AIS. Associated parameters, method codes, scales, and other relevant information can be found there.

The reporting of audit data to AQS is described in Section AT.9.1.

AT.9.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control (QC) includes establishing specifications or acceptance criteria for each quality characteristic of the monitoring/analytical process, assessing procedures used in the monitoring/analytical process to determine conformance to these specifications, and taking any necessary corrective actions to bring them into conformance.

This section describes conditions that are required to determine the outcome of the audit. It includes the frequency of QC checks, limits/criteria for QC results, actions required if QC results are not within limits/criteria (issuance of an Air Quality Data Action (AQDA) request or Corrective Action Notification (CAN)), and procedures for reporting QC data and results.

AT.9.1 FREQUENCY AND REPORTING OF AUDITS

Particulate matter monitors reporting criteria pollutant data (parameter codes 81102, 85129, and 88101) are required to be audited twice per year, per 40 CFR Part 58, Appendix A, Sections 3.2.2 ($PM_{2.5}$) and 3.3.3 (PM_{10}). SASS monitors are non-FEM/FRM methods and typically report non-criteria pollutant data under parameter code 88502 ("Acceptable PM2.5 AQI & Speciation Mass") and other non-criteria parameter codes. Therefore, they are audited annually by QAS, or as requested.

The flow rate of the audit transfer standard and the corresponding flow rate measured by the monitor are reported to AQS. The percent differences between these flow rates are used to evaluate monitor performance. Mass concentrations generated by SASS monitors are usually reported in micrograms per cubic meter of air sampled at Local Conditions (LC). Audit data is reported under the same conditions.

AT.9.2 LIMITS AND CRITERIA

The following table (Table AT.1) provides the acceptable criteria for each audited parameter of SASS monitors. Any identified exceedance of established audit criteria or deviation from operational standards may result in corrective action.

Table AT.1: QAS Control and Warning Limits for SASS audits

Criteria	**Control Limit**	**Warning**
Clock (Pacific Standard Time)	±5 minutes	±2 minutes
Leak rate	≤0.1 lpm	none
Flow rate	±10% from Transfer Standard ±10% from Design flow rate	±4% from Transfer Standard ±4% from Design flow rate
Temperature (ambient and filter)	±2° Celsius	none
Pressure	±10 mmHg	none

AT.9.2.1 SITING CRITERIA

While 40 CFR Part 58, Appendix E contains specific location criteria applicable to SLAMS, NCore, and PAMS ambient air quality monitoring probes and inlets, the Appendix also describes siting criteria applicable to all PM monitors in the CARB Primary Quality Assurance Organization (PQAO). Adherence to these siting criteria is necessary to ensure the uniform collection of compatible and comparable air quality data. The PM-specific inlet siting criteria (in meters) are related to the spatial scale of the monitor as shown below in Table AT.2.

In addition, all monitors must have unrestricted airflow 270 degrees around the inlet.

Collocated monitors must be within 4 meters of each other and at least 1 meter apart for samplers having flow rates less than 200 liters/minute (low volume) to preclude airflow interference, unless an approved waiver is in place. NOTE: Use of collocated instruments with carbon vanes, i.e., Hi-Vol, Anderson RAAS, etcetera, can be a source of contamination and steps should be taken to isolate these instruments.

Table AT.2: Siting Criteria for PM Monitors (distances in meters)

Monitoring Scale	**Inlet Height from Ground**	**Horizontal distance to walls or parapets**	**Distance from inlet to trees**	**Distance from inlet to roadway**
Micro	2-7	>2	>10	2-10
Middle	2-15 2-7 (PMc or near-road)	>2	>10	*refer to chart in CFR
Neighborhood	2-15 2-7 (near-road)	>2	>10	*refer to chart in CFR
Regional	2-15 2-7 (near-road)	>2	>10	*refer to chart in CFR
Urban	2-15 2-7 (near-road)	>2	>10	*refer to chart in CFR

AT.9.3 CORRECTIVE ACTIONS

CANs are issued to document deficiencies that may potentially impact data quality, completeness, storage, or reporting. Refer to the SOP for Corrective Action Notifications (Volume V, Appendix AN) for guidance.

AQDA requests are issued when the audit reveals that the station's monitor(s) are not operating within federal critical criteria or critical CARB control limits. Refer to the SOP for Air Quality Data Action Requests (Volume V, Appendix AO) for guidance.

AT.10.0 REFERENCES

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Met One Instruments, Inc. (Not dated; Copyright 2001). Model SASS and SuperSASS $PM_{2.5}$ Ambient Chemical Speciation Samplers, Field Operation Manual (Document No. SASS-9800 Rev J)

https://metone.com/wp-content/uploads/2019/10/SASS-9800-Rev-J.pdf

United States Environmental Protection Agency. (January 2017). Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II. https://www3.epa.gov/ttn/amtic/files/ambient/$PM_{2.5}$/qa/Final%20Handbook%20Document%201_17.pdf

United States Federal Government Code of Federal Regulations Title 40, Appendix A to Part 58 (October 17, 2006). Quality Assurance Requirements for Monitors used in Evaluations of National Ambient Air Quality Standards https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-58

United States Federal Government Code of Federal Regulations Title 40, Appendix E to Part 58 (October 17, 2006). Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-58

AT.11.0 REVISION HISTORY

Section	Revision 0 (December 2021)
All	New Standard Operating Procedure for Met One Speciated Air Sampling System monitors.