STANDARD OPERATING PROCEDURES

FOR

MET ONE INSTRUMENTS

Speciation Air Sampling System 22LPM

(SASS 22L)

AQSB SOP 402

Second Edition

MONITORING AND LABORATORY DIVISION

June 2020

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CALIFORNIA AIR RESOURCES BOARD

Approval of Standard Operating Procedures (SOP)

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REVISION HISTORY

Edition	Release Data	Changes
First	Sep 2017	New Document
Second	June 2020	ADA Remediation Add Quality Control section Add Personnel Qualification section

LIST OF ACRONYMS

AQSB - Air Quality Surveillance Branch
AMN – Air Monitoring North
AMS – Air Monitoring South
CAN - Corrective Action Notification
CARB - California Air Resources Board
CFD - Custody Field Data
DMS - Data Management System
FRM - Federal Reference Method
LPM - Liters per Minute
LSS – Laboratory Support Section
MLD - Monitoring and Laboratory Division
ODSS - Operations and Data Support Section
OLS – Organics Lab Section
NIST - National Institute of Standards and Technology
NLB – Northern Laboratory Branch
PM2.5 – Particulate Matter 2.5 microns or smaller
PST - Pacific Standard Time
QA - Quality Assurance
QC – Quality Control
QMB – Quality Management Branch
QMS- Quality Management Section
SASS - Speciation Air Sampling System
SCC - Sharp Cut Cyclone
SLPM - Standard Liters per Minute, gas flow at standard temperature and pressure
SOP - Standard Operating Procedure

1.0 GENERAL INFORMATION

1.1 Introduction:

The purpose of this Standard Operating Procedure (SOP) is to document the Met One Speciation Air Sampling System 22 LPM (SASS 22 L) procedures utilized by the Air Quality Surveillance Branch of the California Air Resources Board (CARB). The goal of this SOP is twofold; to formalize SASS 22L installation, configuration, and operation procedures in order to ensure comparability of all SASS 22L data reported within CARB's network, and to describe supplemental information and modifications to the SASS 22L Operation Manual necessary to successfully integrate the SASS 22L into CARB's ambient air monitoring network. The Met One Instrument's SASS 22L Operation Manual contains a significant source of information pertinent to the operation, maintenance, and understanding of this instrument, and therefore CARB highly recommends a thorough review of the SASS 22L Operation Manual.

1.2 General Description and Theory of Operation:

The Met One SASS 22L is a five-channel sampler designed to collect PM2.5 on various collection media for speciation. The sampler operates at volumetric flow rates of 6.7 liters per minute (LPM) on channels 1-3 & 5, and a volumetric flow rate of 22.0 LPM on channel 4. The PM2.5 cut-point is achieved by utilizing sharp cut cyclones. CARB utilizes three types of filter media for the speciation program: 47 mm Teflon, 47 mm nylon, and 25 mm quartz fiber filters. The particles collected on the 47 mm diameter Teflon filter will be used for mass and metals analysis or wood smoke (Levoglucosan). The particles collected on the 47 mm diameter nylon will be used for ion analysis. The particles collected on the 25 mm diameter quartz fiber filters will be used for carbon analysis. See Figure 1 for a schematic of the Met One SASS 22L sampler.

Electronic systems in the sampler are designed to monitor and maintain the volumetric flow rate as well as record the elapsed sampling time enabling the SASS 22L to calculate the total sample volume in cubic meters (m^3). Using this information, the analyzing laboratory will calculate and report the average PM2.5 concentrations for the sampling period in $\mu g/m^3$.

The SASS 22L monitors and regulates the flow rates for all the channels using the sampler's microprocessor, software, mass flow controllers, ambient temperature sensor, and ambient pressure sensor. The sampler, along with the analytical analyses, can generate results for 58 different air quality parameters.

Data from a previous run can be downloaded to a laptop or PC via a RS232 cable and the FSCommAQ software or the data can be accessed from the screens on the instrument.

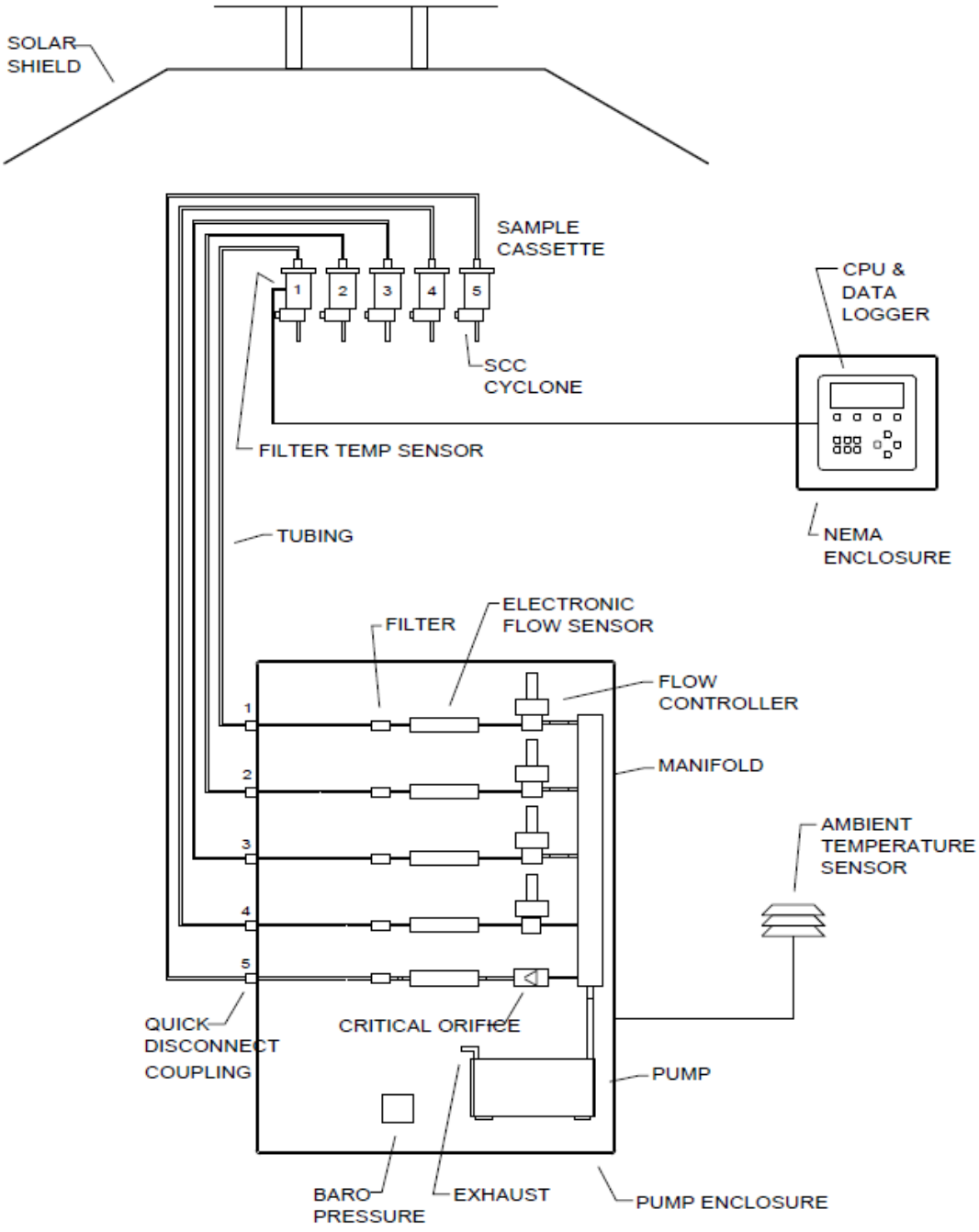

Figure 1: Schematic of SASS 22L Sampler

1.3 Safety Precautions:

Think "safety first". High voltages (120 volts AC) are used to power the unit. Unplug the sampler whenever possible while working around electrical components.

Due to typical rooftop installations, the risks of working outdoors at elevated heights should also be considered. To prevent injury from the sampler falling over, the sampler should be securely mounted to the stand using the included hex head bolt hardware and washers. The stand should be properly secured or anchored to the floor/platform.

Rooftop sampling creates a hazard from falling. Be careful climbing and descending to and from the rooftop platform. For additional safety information read Section 2.0 "Unpacking, Siting, and Installation", section of the Met One SASS 22LPM Operating Manual. Staff working on rooftop platforms should complete CARB's climb safety training.

Ensure that the green (and/or green/yellow) grounding cable is connected to an appropriate grounding source. For maximum effectiveness, the ground cable should be connected to a nearby earthed ground rod. In addition, it is recommended that one leg of the mounting tripod also be grounded to the same earth ground used to ground the pump box.

1.4 Interferences:

Precaution must be taken when handling the SASS filter canisters. It is recommended that the instrument operator wear powderless nitrile gloves when handling the cassettes to prevent contamination. The internal filters are delicate. Any foreign object falling into the filter canisters may result in pinholes/contamination and, subsequently, the invalidation of the sample.

1.5 Personnel Qualifications:

Only properly trained personnel should perform installation, operation, maintenance, repair, or calibration of the SASS 22 L Sampler. Personnel should meet all minimum requirements and qualifications commensurate with their position or title. Qualifications for the respective staff functions are initially established through the successful completion of a probationary period with supervisorial oversight. Successive levels of responsibility are achieved via internal and external training classes, experience, and a demonstrated display of abilities until a "journey level" is attained.

2.0 INSTALLATION PROCEDURE

2.1 Physical Inspection:

Inspect equipment and accessories for completeness and check for any shipping damage upon receipt of a SASS 22L sampler. If equipment is missing or damage is found, immediately notify your supervisor and/or your agency's shipping department.

2.2 Siting:

The type of sampling to be conducted will dictate siting of the SASS 22L. An effort should be made to meet siting guidelines stated in the Code of Federal Regulations, Title 40 Part 58. Ensure the sampler inlet at least 1 meter, but not more than 4.2 meters, from other PM samplers and that the sampler has an unobstructed airflow of a minimum of 2 meters in all directions. Note, all other "low flow" samplers should be at least 1 meter away, 2 meters from "high flow" (>200 LPM) samplers. Collocated sampler installations should be 1 meter apart.

2.3 Tools:

The SASS 22L sampler contains a tool kit that has the equipment necessary to assemble the sampler. A drill is required to bolt the tripod and pump box to the platform. Review the operator's manual and the steps below completely before installing.

2.4 Tripod Assembly:

Remove the three pins holding the legs in the upright position. Lower the legs and reinsert the pins to lock the legs in the down position. The tripod must be anchored to the platform to ensure that it will not tip over in strong wind or inclement weather. If the platform is made of wood, 1/3'' lag screws are advised.

2.5 Sampling Head Installation:

The bottom and top shields of the sampling head are attached when shipped. Detach the bottom shield and slide it past the hoses and cables that are attached to the upper sampling head. Remove the pin on the side of the bottom shield. Slide the shield down the tripod with the open side of the shield facing upwards.

Find the bag of three 8-32 x 3/16'' socket head screws in the tool kit. The

correct screws have been treated with a red thread locking compound. Install two screws into the two tapped holes in the mast.

Remove the gray PVC shipping tube from the center of the upper sampling head. Unwind the sampling lines attached to the sampling head. Feed the lines down the center of the mast and slide the head onto the mast. Aligning the notch in the sampling head with the upper socket head screw in the mast allows the head to slide completely downward. Tighten the two socket head screws in the sampling head to secure it to the mast. Raise the bottom shield and align the notch with the lower set screw in the mast. Put the pin in place to lock the shield in the raised position.

2.6 Control Unit and Temperature Sensor Mounting:

Using two U-bolts, four 7/16" nuts, and four washers, mount the control unit just above the tripod legs. The control unit will face upwards with the cable connections on the bottom when properly oriented.

The temperature sensor mounts to the tripod with a U-bolt, two 7/16" nuts, and washers. Align the top of the probe's radiation shield with the top of the control box. Place the sensor so that it is oriented 180° in relation to the control box.

2.7 Pump Box Mounting:

Place the pump box close to the base of the tripod to ensure that all cable connections can be made. Anchor the pump box using lag bolts or other appropriate hardware. There are pre-drilled holes in the legs of the unit for this purpose.

Plug the pump box power cord into a 110 V AC power source. Connect the sensor cable and the control box power cable into the control box. There are five quick-disconnect valve connectors on the pump box numbered 1-5. These numbers correspond to the channels on the SASS 22L sampling head. Each pump line from the head is numbered; connect each line to the corresponding quick-disconnect valve. Channel 5 may be connected or the pump line and valve may be left disconnected. If channel 5 is disconnected, place the orange caps over the sample line connection points. Connect the green and yellow grounding cable to an appropriate ground source.

Figure 2: Assembled SASS 22L Unit

2.8 Sample Canister Mounting:

The sample canisters will contain the filters and denuders when they arrive from the laboratory. The sharp-cut cyclone (SCC) inlets must be installed and the sample canisters must be placed onto the appropriate channels in the sampling head. Placing a very small amount of O-ring lubricant (silicone grease) on the O-rings will facilitate insertion of the cyclone and the canister. Remove the plugs on both ends of the sample canister. The SCC is inserted into the side of the canister with only one lock screw. Rotate the SCC until the metal plate on the cyclone locks into the lock screw on the canister. From this point on ensure the canister is oriented SCC side down to keep the filters from being contaminated.

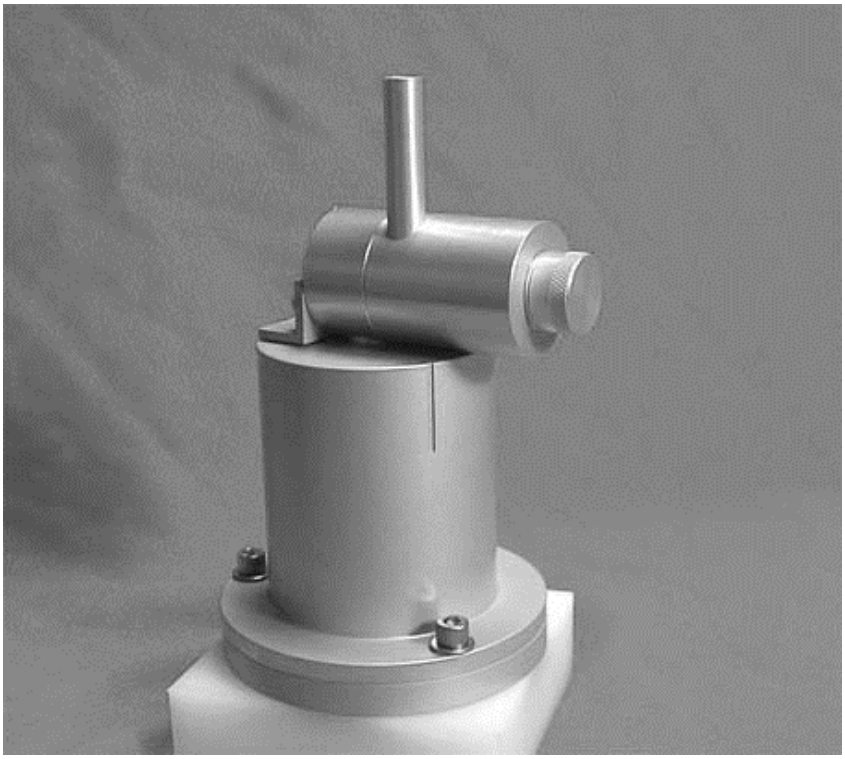

Figure 3: SASS Canister

The two lock screws on the upper side of the canister are inserted into the guides on the sampling head. Align the lock screws with the wider portion of the guides, ensuring that the mark on the canister faces outward. Push the canister upward and rotate counterclockwise to lock it into place. A small amount of silicone grease on the O-rings will make canisters easier to install. Once all the canisters have been installed, raise the radiation shield and lock it in place.

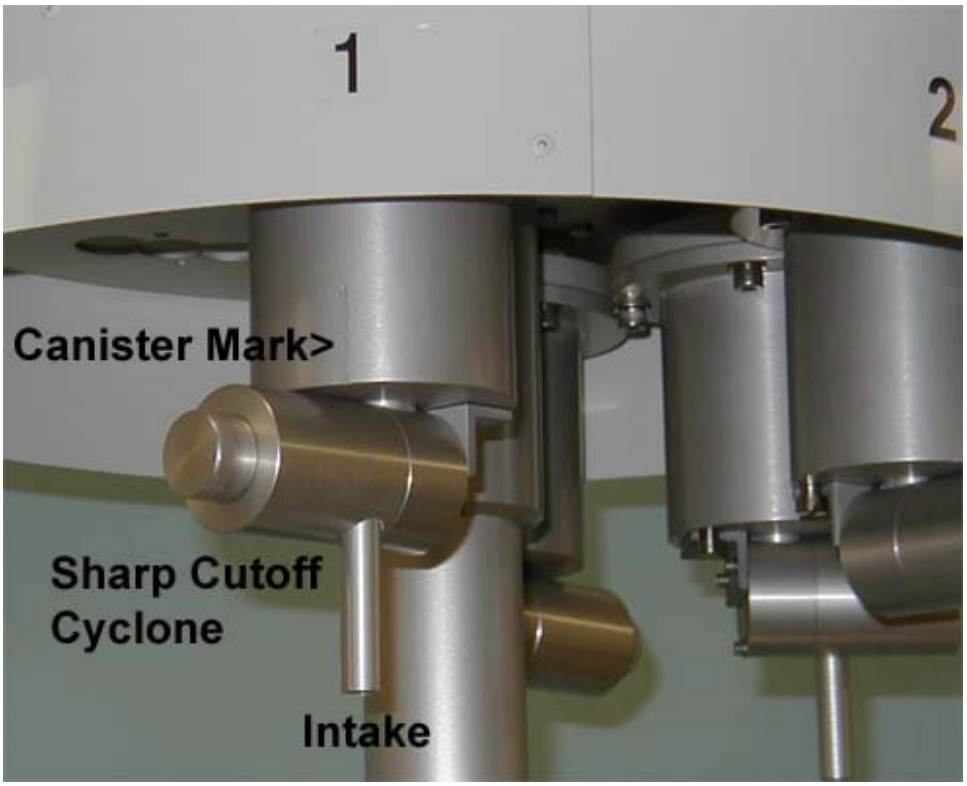

Figure 4: Canister Installation

3.0 CONFIGURATION

3.1 Time and Date Setup:

Press the "SETUP" key in the main menu to set the date and time. Press "F3" to get to the clock menu. Use the left and right arrows to move the cursor. Use the up and down arrows to adjust values, as necessary. Set sampler time to current Pacific Standard Time.

3.2 Event Setup:

Press the "SETUP" key to begin programming a sampling event. Press "F1" to activate the event manager. Set the start date and time using the up and down arrow keys to change values and the left and right arrow keys to move the cursor. Edit the event length time to the desired run interval. (The default run interval is 24 hours.) Choose the canister set to be activated (default is 1, 2, 3, 4). Press "SAVE" to store the event. The SASS 22L allows up to four events to be preprogrammed. Programming back-to-back events must have a 6 to 10 minute gap between events. Press "F1" to review the event to ensure proper storage and setup, and then select "EXIT" to go to the main menu.

3.3 Sample Retrieval Time:

Sample canisters need to be removed within 48 hours after sampling. If the 48-hour retrieval time cannot be met due to logistical reasons (e.g. weekends and holidays), the field operator has two options. The second option is preferable.

1. Retrieve the sample on the next available business day. For informational purposes, the sample will be flagged in Northern Laboratory Branch's laboratory information management system for not meeting the 48-hour retrieval time. However, this flag will not carry over to US EPA's Air Quality System database, **or**

2. Perform a make-up sample run per the guidance given below.

3.4 Make-up Guidelines

Every effort should be made to perform a make-up sample as the reported data may be utilized in the State Implementation Plan (SIP) process. Should a make-up sample be collected, the criteria below must be followed.

1. A sample make-up must be performed after the missed regularly

scheduled sample run (before the next required sampling day). The make-up sample should also occur within the same sampling month as the missed sample run.

2. If one or more sample is invalidated, then all four SASS (i.e. canisters) channel samples must be re-sampled (on new media).

3. For sample runs scheduled on a Friday, or instances such as a Saturday with a Monday holiday, delay the run to the next day so that the sampled canisters can be collected within the 48 hour required period. These delayed samples will be considered make-up runs.

4. Field blank canisters may be used to collect valid samples if the operator cannot acquire make-up canisters before the next required sampling day. After completion of the make-up run, record all the pertinent make-up sample information onto the re-labeled field blank form. Refer to a previous completed SASS field data form to reference all information that must be recorded. A replacement set of field blank canisters will need to be sent to the operator. Notify LSS Sample Handling so that a replacement field blank set can be prepared.

4.0 DATA RETRIEVAL

4.1 General Information:

Field personnel will have the responsibility of ensuring the PM2.5 sampling information for each filter run is properly retrieved. The sampling information for the sample can be either obtained manually or electronically downloaded to a computer using FSCommAQ Software.

For each sample, field personnel will complete a PM2.5 Speciation Custody and Field Data Form (Appendix C). Use the Previous Event Summary option on the event menu to retrieve necessary data to complete this form.

The event summary information can also be downloaded with the FSCommAQ software. The SASS 22L sampler can store the 5-minute data for one run. If 5-minute data is needed for a run, it must be collected before the next run. If the 5-minute data is required, it must be downloaded via the FSCommAQ software. **It is a good practice to download both the event summary and 5-minute data after each sampling event.**

4.2 Viewing Sample Summaries:

1. Select "Event" option from the main screen, then "F2" button to retrieve the previous data record. It now displays the summary of the sample event, including start and stop dates and times, along with elapsed time of the sample.

2. Press the button under the >> to move to the next screen to finish recording all necessary values. This will include start and end date/time, sample retrieval date/time (using the current time and day), sampler collection information (temperatures, pressures, volumes, flow CV, flows, and note any flow or dT warnings).

4.3 FSCommAQ Software:

To download run data from the SASS 22L Control Box with a laptop use the FSCommAQ software and the included RS-232 cable. The latest version of FSCommAQ software at the time writing this document is version 1.2.0. The FSCommAQ software user's manual can be downloaded from the Met One Instruments website.

The included RS-232 Cable (Met One part # 3169) must be used for communication with the SASS 22L. Place the round four-pin connector into the

appropriate connector on the SASS 22L Control Box. Next place the nine-pin serial port connector onto the serial port of the laptop. A USB to serial adapter may be needed for laptops without a serial port. Note the com port setting on the serial port.

Ensure that the cables are connected properly and start the software. Select the com port corresponding to the serial port used by the SASS 22L and click on the "Retrieve Data" button. If only the event data summary is needed, choose yes at the "Would You Like to Only Download the Event Data" screen. If 5-minute data is desired, choose no. Data can either be viewed within the program or exported as a comma-delimited text file for import into a spreadsheet. Two files are downloaded for each run. The .bin files are FSCommAQ formatted. The .csv files are comma-delimited text files that can be viewed with most spreadsheet software. For problems with transferring data files, refer to troubleshooting section of this document.

5.0 SAMPLE CANISTER HANDLING AND RETERIVAL

5.1 General Information

Federal regulations stipulate specific sampling criteria for PM2.5 sampling. If these sampling criteria are not met, sample filters may be considered invalid or flagged by the receiving laboratory. In addition to these requirements, operators should practice care to prevent or minimize contamination of the sample filter canisters, or anything else which may come in contact with the sample filters.

5.2 Pre-Sampling Canister Handling Procedures

Sample canisters must be used within 30 days of pre-weighing date. If 30 days have elapsed before the canister set is to be used, do not use this set of canisters. Note the reason for not using them on the sample form, return the set to the laboratory, and ask for a replacement set.

The sample canister temperature must be within 5 °C of the ambient temperature when installed on the sampler.

5.3 Canister Handling:

It is recommended that the instrument operator wear powderless nitrile gloves when handling the cassettes to prevent contamination.

The sampling canisters and leak check canisters must be capped when not in use. Remove the sampling canisters within 48 hours after sampling and place in cold storage immediately. To remove the canister, rotate the canister clockwise until it stops and pull down. While keeping the SCC end pointed downwards, twist the SCC until the metal plate disengages from the locking screw and remove. Cap the ends of each canisters and store them in a refrigerator. The canisters may be stored in a freezer if a refrigerator is not available. Sampled canisters must be kept at a temperature ≤ 5 °C during storage and shipping.

Ship the canisters within 96 hours after sample retrieval. Canisters are to be shipped under cold conditions because it is important the samples be received in the laboratory ≤ 5 °C. If the samples arrive with temperatures above 5 °C, they may be invalidated, and make-ups will need to be completed. If the samples will be temporarily stored, it is important to continue to store the samples in a refrigerator set at ≤ 5 °C (or freezer if a refrigerator is not available).

5.4 SCC Inlets:

Use each SCC inlet on the same channel for every sampling event, leak and flow checks. SCC inlets should be cleaned monthly or more frequently if needed.

5.5 PM2.5 Speciation Custody and Field Data Form:

After retrieving the sampled canisters, the PM2.5 Speciation Custody and Field Data Form (CFD, see Appendix C) will need to be completed.

1. Select "Event" option from the main screen, then "F2" button to retrieve the pervious data record. It now displays the summary of the sample event, including start and stop dates and times, along with elapsed time of the sample. Record these values on the CFD form.

2. Press the button under the >> to move to the next screen to finish recording all necessary values. This will include start and end date/time, sample retrieval date/time, sampler collection information (temperatures, pressures, volumes, flow CV, flows, and note any flow warnings).

3. If the CV > 2.1 percent or if there are any Filter dT Warnings or Flow Warnings for any sample canisters, the field operator should write **INVALID** on the CFD form. A make-up sample should be scheduled (see Section 3.4 Make-up Guidelines). If more sampling canisters sets will be needed, contact lab personnel to request additional sample media.

4. Field personnel should also note any unusual local conditions they may have observed during the sample run by circling the appropriate condition code. Remember to include any post-sampling information and comments. Please double-check entries and write clearly.

5. It is suggested that the site operator make a copy of the form if possible. These documents would be kept in accordance to CARB Record Retention Documentation Policy.

5.6 Post-Sampling Canister Handling Procedures

Sampled canisters must be removed from the sampler within 48 hours after the end of sampling and placed in cold storage immediately. Sampled filters must be kept at a temperature ≤ 5 °C during storage and shipping. Ship the canisters within 96 hours after sample retrieval.

Sampled canisters and the PM2.5 Speciation Custody and Field Data Form are to be shipped in an insulated shipping container containing sufficient Blue Ice

or other chilled media to assure that sample filters arrive at the laboratory with a temperature no greater than 5 °C. Other cold storage methods may also be employed if they comply with these temperature requirements. This requirement also applies when sampled filters are being transported from remote or satellite sites to central or main locations. Samples received by the laboratory at temperatures greater than 5 °C may be invalidated. The laboratory should note this on the field sample report form, and document in LIMS. The lab personnel will immediately notify the field operators if the samples arrive greater than 5 °C, or if any other invalidations occur so that field operators know to perform a make-up (see Section 3.4 Make-up Guidelines).

Sampled filters should be shipped to the laboratory weekly on Monday, Tuesday, or Wednesday to avoid Saturday, Sunday, or holiday arrivals when staff may not be present to receive the samples.

More information about the laboratory documentation and handling procedures can be found in the Standard Operating Procedure for the Filter and Canister Preparation for PM2.5 Speciation Samples Northern Laboratory Branch (SOP MLD 062).

5.7 Field Blanks:

One set of field blanks will be shipped from the laboratory every quarter. They will have a separate PM2.5 Speciation Custody and Field Data Form (Appendix C). The field blanks will be labeled with channel numbers and colored dots. Install the field blanks prior to installing normal run canisters. Install the field blanks in channels 1-4 as labeled with SCC. The canisters should be installed for approximately 5 minutes. Remove the canisters and the cyclones, cap the ends of the field blank canisters, and return to the shipping bin. As with field samples, ship the canisters within 96 hours after sample retrieval. Install routine sampling canisters according to schedule.

6.0 CALIBRATION PROCEDURES

6.1 General Information:

This section of the SOP covers the calibration procedures for the Met One SASS 22L. This document is intended to supplement the manufacturers operating manual and should not be used as a substitute. Read the procedures outlined in this document and examine the user's manual before attempting to calibrate a SASS 22L unit.

The SASS 22L sampler requires calibration of the ambient temperature sensor, barometric pressure sensor and each flow controller. Perform the SASS 22L sampler calibration using the following steps:

1. Time Verification/Adjustment
2. Leak Check
3. Temperature Sensor Calibration
4. Pressure Calibration
5. Flow Calibration

6.2 Apparatus for Met One SASS 22L Calibration:

- NIST traceable Flow Transfer Standard for 6.7 LPM
- NIST traceable Flow Transfer Standard for 22.0 LPM
- NIST traceable time standard
- NIST traceable pressure (P) standard
- NIST traceable temperature (T) standard

- 4 PM2.5 Sharp Cut Cyclones (SCC) (3 for 6.7 LPM, 1 for 22.0 LPM)
- 4 Calibration Canisters with appropriate filters and denuders in place
- Calibration worksheet
- Two 1 to 2 Liter vessels to hold water for temperature calibrations
- A hot plate
- A bag of ice
- A gas-tight syringe (@ 60 cc capacity), tubing with a "tee"
- Fittings to connect to the P standard and the sampler's pressure transducer inlet
- Met One SASS Field Operations Manual
- Access to the SASS 22L sampler tool kit, and other basic tools (screwdrivers, wrenches, zip ties, etc.)

6.3 Pre-Calibration Preparations:

Install the correct filters in each calibration canister to simulate flow conditions during sampling. Use a 47 mm diameter Teflon filter on channel one, a nylon 47 mm diameter filter on channel two, a 47 mm diameter Teflon filter on channel three, and a 25 mm diameter quartz filter on channel four. Use these canisters only for calibrations, verifications, and leak tests. Test canisters should be replaced at a minimum of every two years.

Plug in and turn on the flow, pressure and temperature standards to let them warm up for about ½ hour. Place the flow, P and T standards in the shade if possible.

Prepare the SASS 22L calibration worksheet 402 while waiting for the standards to acclimate.

6.4 Time Adjustment:

Press the "Setup" Key from the main menu. Press "F3" to choose clock menu. Compare the clock setting on the sampler with a time standard. Enter the date and time in the laptop calibration spreadsheet for both the sampler and the NIST time standard. If the sampler clock is more than 2 minutes from Pacific Standard Time, use the left and right arrow keys to move the cursor and the up or down arrow keys to adjust the time. Press "Save" before exiting. Record the values in the calibration worksheet.

6.5 Leak Test:

To perform a leak check, install calibration canisters and SCC with appropriate filters on each channel to be checked. A canister with a Teflon filter must be installed in channel one. A canister with a nylon filter must be installed for channel two. A canister with a Teflon filter must be installed in channel three. A canister with a quartz fiber filter must be installed in channel four. Appropriate sharp cut cyclones must be installed on all the canisters.

Press the "Calibrate" key in the main menu. Press "F1" to enter the "System Test" screen. Select "Calibrate Flows". Press "Pump On" the turn on the pump. Let the sampler operate for about 5 minutes to warm up.

Observe the flows on the first four channels. The displayed flow rate should be 6.7 LPM on channels 1-3 and 22.0 LPM on channel 4. Press the "Leak" key. Cover the inlet of the sharp cut cyclone on channel one. Observe the flow rate displayed for channel one. The flow rate should drop to 0.1 LPM or less. Ensure that the flow remains at or below 0.1 LPM for at least 30 seconds. If the

display remains at or below 0.1 LPM, that channel passes the leak test. Slowly remove the cover from the inlet to keep the filter from breaking. Record the results in the laptop calibration spreadsheet. Repeat this procedure for channels two, three, and four. Record the values on the calibration worksheet.

If the leak check fails, troubleshoot the error, and redo the leak check. Refer to section 10.2 for more information.

6.6 Ambient Temperature Sensor Calibration:

The ambient temperature sensor must be accurate to ±2 °C because the SASS 22L sampler flow rates are calculated in volumetric flow. Calibrate the ambient temperature sensor upon installation. The ambient temperature sensor must be removed from the ambient temperature sensor shield before beginning the calibration. Once the sensor has been removed from its housing, follow the steps described below to complete the calibration.

The calibration procedure requires water, a hot plate, ice, and containers to hold the water baths. Two points are necessary for a calibration. An ice bath is used to provide a 0 °C reference point, and the second should be a water bath of a high temperature (50 °C is a common point). Use the following steps to calibrate the temperature sensor:

1. Enter the Calibration menu. Press “F3” to select the “Temperature Calibration” screen. Press the up and down arrows until the display reads "(0)" in the upper left corner. The "0" indicates the ambient temperature sensor calibration screen.

2. Prepare an ice bath. Place the temperature standard and the ambient temperature probe into the bath near each other. Allow the probes to equilibrate for at least 5 minutes.

3. Enter the reading from the temperature standard into the reference column for point 1.

4. Press “F1” to save this reference point.

5. Repeat step 2 with a 50 °C water bath.

6. Enter the reading from the temperature standard into the reference column for point 2. Press “F4” to save this reference point. When points one and two have been saved, press the “Calibrate” button to save the settings.

7. Perform a temperature verification on the SASS 22L sensor. If the ambient

sensor is more than ±2 °C from the standard, perform another calibration. If the sensor is still not within acceptable parameters, the SASS 22L will need repair.

8. Record results on the calibration worksheet.

6.7 Filter Temperature Sensor Calibration:

The filter temperature sensor must be accurate to ±2 °C because the SASS 22L sampler flow rates are calculated in volumetric flow. Calibrate the filter temperature sensor upon installation.

A similar procedure to the ambient temperature will be used for the filter temperature, except that for the filter temperature calibration, use the local ambient temperature as a single high reference point.

Use the following steps to calibrate the filter temperature sensor:

1. Enter the Calibration menu. Press "F3" to select the "Temperature Calibration" screen. Press the up and down arrow keys until the display shows "(1)" in the upper left corner. The "1" indicates the filter temperature sensor calibration screen.

2. Insert a temperature probe into the open hole after canister #1 has been removed. Allow 10 minutes for the temperatures to stabilize, and then compare the reference thermometer with the filter temperature screen.

3. Enter the reading from the temperature standard into the reference column for point 2 (upper temperature).

4. Press "F4" to save this reference point. Once the point has been saved, press the "Calibrate" button to save the settings.

5. Perform temperature verification on the SASS 22L sensor. If the filter sensor is more than ±2 °C from the standard, perform another calibration. If the sensor is still not within acceptable parameters, the SASS 22L will need repair.

6. Record results on the calibration worksheet.

6.8 Pressure Sensor Calibration:

Since the SASS 22L sampler uses volumetric flow the pressure sensor must be accurate to ±10 mm Hg. Open the pressure port on the P standard to ambient.

(Sometimes there are plugs at the inlet of the sensor to keep dust out.) Allow the pressure standard to warm up for at least ½ hour before performing a verification/calibration.

The barometric pressure sensor is in the pump box housing. To access the sensor, unscrew the four (4) screws along the bottom of the housing and remove the cover. The pressure test port is next to the power supply housing. This procedure will require a gas tight syringe, tubing, and a tee. This is a 2-point calibration at 600 and 800 mm Hg. The following steps outline the pressure sensor calibration procedure.

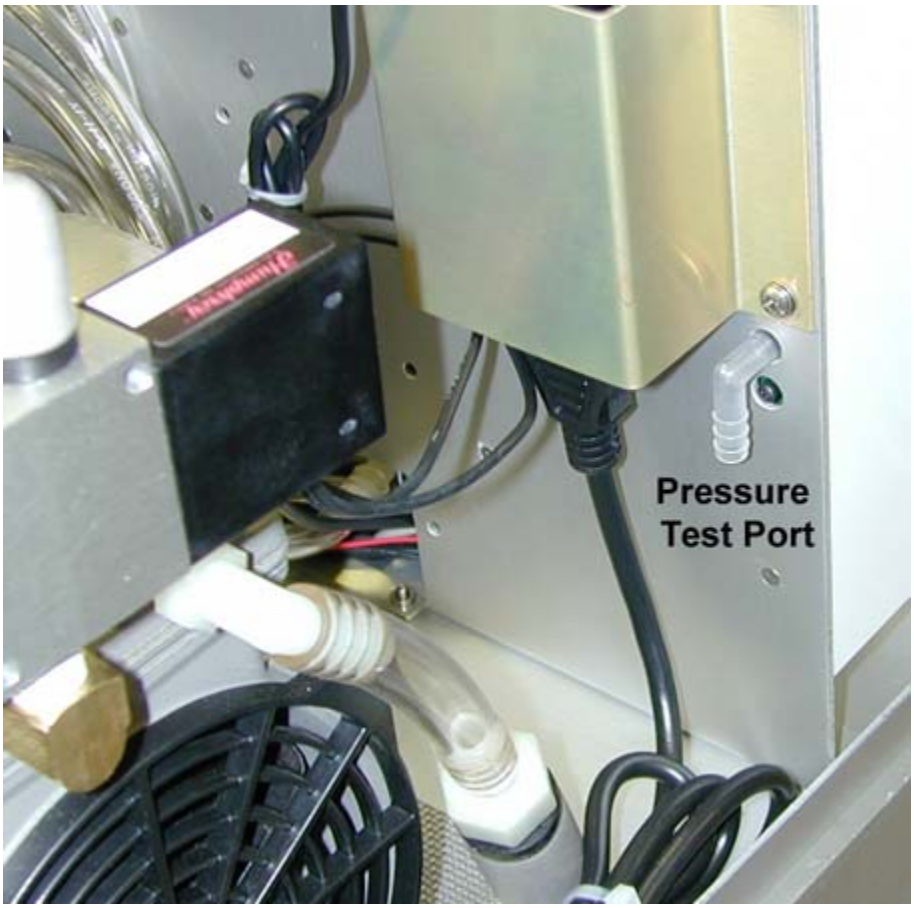

Figure 5: Pressure Test Port Location

1. In the "Calibrate" menu press "F4" to reach the "Pressure Calibration" Menu.

2. Connect the SASS 22L pressure test port, the syringe, and P standard test port together with tubing and the tee.

3. Adjust the syringe plunger until the P standard reads 600 mm Hg. Enter the value on the P standard into the reference column on point 1. Press "F1" to save the setting.

4. Adjust the syringe until the P standard reads 800 mm Hg. Enter the value on the pressure standard into the reference column on point 2 in the control panel display. Press "F4" to save the setting.

5. Press the "Calibrate" button to save the calibration points. Remove the syringe, tubing, and re-check both the 600 and 800 mm Hg points. If the sensor still exceeds ±10 mm Hg of the standard, perform another calibration. If it still exceeds the ±10 mm Hg limit, the sampler must be repaired.

6.9 Flow Calibration Setup:

The current version of the SASS 22L sampler has five channels. The first three channels are designed to operate at 6.7 LPM, channel four is designed to operate at 22.0 LPM, and channel five is designed to operate at 6.9 LPM. Since channel five is not utilized in standard operating conditions, it will not need to be checked or calibrated. Channels 1, 2, 3, and 4 have active flow control. Mass flow controllers on the channels actively maintain a constant flow. Channel 5 has a critical orifice to maintain the flow. Flow through these orifices can vary significantly if there is a large amount of filter loading. Therefore, channels one, two, three, and four are the only channels that should be used for sampling.

The SASS 22L samplers are operated in the "volumetric" flow mode. Therefore, it is necessary to ensure that the temperature and pressure sensors are within acceptable limits before performing flow calibrations. In addition, a leak check should be performed on all channels prior to a flow calibration.

If the calibrations canisters are not already installed (from leak check), please install the calibration canisters with SCCs. A canister with a Teflon filter must be installed in channel one. A canister with a nylon filter must be installed for channel two. A canister with a Teflon filter must be installed in channel three. A canister with a quartz fiber filter must be installed in channel four. Appropriate sharp cut cyclones must be installed on all the canisters.

6.10 Flow Calibration:

If the flow rate verification for channels 1-3 is greater than ±2 percent of the 6.7 LPM (±0.268 LPM) or channel 4 is greater than ±2 percent of the 22.0 LPM

(±0.88 LPM), that channel must be adjusted and re-calibrated. Use the following procedure for calibration. Note a passing Leak Test should be performed before a Flow Calibration.

1. Press "F2" in the Calibration menu to reach the "Flow Calibration" screen. Press, "Pump" to turn the pump on. Allow the pump to warm up for 5 minutes, and then connect the flow standard to the channel to be calibrated.

2. Place the cursor on the "Channel" column, use the up, and down arrows to scroll to the correct channel. Read or calculate the volumetric flow rate on the transfer standard. Equations for converting standard flow to volumetric flow can be found in the Section 7.5 if needed. Enter the volumetric flow rate in the "Ref" column and press the "Calibrate" key. Within 20 seconds the system will update with the new displayed flow rate on the SASS 22L display. Exiting out of the calibration screen and returning will ensure that the SASS 22L software has updated the calibration.

3. Check the updated flow rate on the SASS 22L against the transfer standard. If the actual flow is not within ±2 percent of the displayed flow, repeat step 2. The displayed flow must also be within ±2 percent of 6.7 LPM (±0.134 LPM) for channels 1-3 and within ±2 percent of 22.0 LPM (±0.44 LPM) for channel 4. Repeat the calibration procedure if the SASS 22L does not meet the ±2 requirement. Once the calibration is complete, record the displayed and actual flow values into the calibration sheet.

4. Repeat the previous steps for the other channels. When complete, ensure that the calibration sheet has been filled out. Turn off the sampler and remove the calibration canisters. Plug the ends of the calibration canisters to preserve them for the next flow test. Exit the calibration screen and return to the main menu.

A copy of the calibration form is illustrated in Appendix B.

7.0 VERIFICATION PROCEDURES

7.1 General Information:

The SASS 22L sampler requires monthly verification of the ambient temperature sensor, barometric pressure sensor and each flow controller. These checks must be documented on monthly QC form 402. Perform the SASS 22L sampler verification using the following steps:

1. Time Verification
2. Leak Check
3. Temperature Verification
4. Pressure Verification
5. Flow Verification

7.2 Time Verification:

Press the "Setup" Key from the main menu. Press "F3" to choose clock menu. Observe the clock time setting on the sampler. Record sampler and time standard date and time and record on the maintenance check sheet. If the sampler clock is more than 2 minutes of Pacific Standard Time, adjust the clock value. The calibration procedures are detailed in section 6.0, Calibration Procedures.

7.3 Leak Check:

To perform a leak check, install canisters with appropriate filters and SSCs to each channel to be checked. A canister with a Teflon filter must be installed on channel one. A canister with a nylon filter must be installed for channel two. A canister with a Teflon filter must be installed on channel three. A canister with a quartz fiber filter must be installed on channel four. Appropriate sharp cut cyclones must be installed on all canisters.

Press the "Calibrate" key in the main menu. Press "F1" to enter the "System Test" screen. Select "Calibrate Flows". Press "Pump On" the turn on the pump. Let the sampler operate for about 5 minutes to warm up.

Observe the flows on the first four channels. The displayed flow rate should be 6.7 LPM on channels 1-3, and 22.0 LPM on channel 4. Press the "Leak" key. Cover the inlet of the sharp cut cyclone on channel one. Observe the flow rate displayed for channel one. The flow rate should drop to 0.1 LPM or less. Ensure that the flow remains at or below 0.1 LPM for at least 30 seconds. If the display remains at or below 0.1 LPM, the channel passes the leak test. Slowly remove the cover from the inlet to keep the filter from breaking. Record the

results in the laptop calibration spreadsheet. Repeat this procedure for channels two, three, and four. Record the values on the maintenance check sheet.

7.4 Ambient Temperature Sensor Verification:

Place temperature probe of the T standard within the radiation shield of the ambient temperature sensor. If using the BGI DeltaCal, use the external temperature probe. Avoid exposing the sensor to direct sunlight. The temperature probe must be within the radiation shield for at least 5 minutes. If the temperature standard was in a different environment (i.e. in a colder or warmer building/car than ambient temperature), make sure the temperature standard is stable before comparing values.

1. Press the "Calibrate" key. Press "F1" to reach the "System Test" screen.

2. Observe and record the ambient temperature value on the system test screen on the maintenance check sheet.

3. Compare the temperature standard reading to the sampler temperature reading. Record the value on the worksheet. If the difference from true is less than ±2 °C, the ambient temperature sensor passes. If the difference from true is greater than ±2 °C, the ambient temperature sensor fails and must be calibrated. The calibration procedures are detailed in section 6.0, Calibration Procedures.

7.5 Filter Temperature Sensor Verification:

Place temperature probe of the T standard into the port of channel 1 on the sampling head. If using the BGI DeltaCal, use the external temperature probe. Avoid exposing the sensor to direct sunlight. The temperature probe must be within the port for at least 5 minutes.

1. Press the "Calibrate" key. Press "F1" to reach the "System Test" screen.

2. Observe and record the filter temperature value on the system test screen on the maintenance check sheet.

3. Compare the temperature standard reading to the sampler temperature reading. Determine the difference from true and record the value on the worksheet. If the difference from true is less than ±2 °C, the filter temperature sensor passes. If the difference from true is greater than ±2 °C, the filter temperature sensor fails and must be calibrated.

7.6 Pressure Sensor Verification:

Since the SASS 22L sampler uses volumetric flow the pressure sensor must be accurate to ±10 mm Hg. The pressure port on the P standard needs to be open to ambient. (Sometimes there are plugs at the inlet of the sensor to keep dust out.) Allow the pressure standard to warm up for at least ½ hour before performing a verification.

1. Press the "Calibrate" key in the main menu. Press "F1" to reach the "System Test" screen.

2. Observe and record the values of the sampler's ambient pressure sensor in the laptop calibration sheet. Read or calculate the pressure value from the pressure standard and enter it into the maintenance check sheet.

3. If the difference from true is less than ±10 mm Hg, the ambient pressure sensor passes. If the difference from true pressure is greater than ±10 mm Hg, the ambient pressure sensor fails, and the pressure sensor must be calibrated. The calibration procedure is outlined in the section 6.0, Calibration Procedures.

7.7 Flow Verification:

1. Press the "Calibrate" key. Press "F1" to get to the "System Test" screen.

2. Press the "Pump" key. Allow the pump to run for 5 minutes.

3. Connect the flow transfer standard to the channel 1 inlet. If using a transfer standard that gives standard flow you must convert it to volumetric flow. Use the following equation:

$$V\text{olumetric Flow} = \frac{(\text{Std. flow} *)(760\text{mm Hg})(\text{ambient temp in K})}{(\text{ambient pressure in mm Hg})(298\text{K})}$$

*__Note__: the equation for standard flow used above is:

$$\text{std. flow} = [(\text{MFM disp})(\text{MFM cert. slope})] + (\text{MFM cert. intercept})$$

The above calculations are not necessary if your transfer standard reports volumetric flow directly. The SASS 22L should display a flow within ±4 percent of 6.7 LPM (6.43-6.97 LPM) for channels 1-3, and within ±4 percent of 22.0 LPM (21.12-22.88 LPM) for channel 4. Record the SASS 22L displayed flow and the transfer standard flow on the maintenance check sheet.

4. Repeat step 3 with channels 2, 3, and 4. If a channel does not pass the flow verification that channel must be calibrated. The calibration procedure is outlined in the section 6.0, Calibration Procedures. In addition, field operators need to investigate when this problem started, and initiate a Corrective Action Notification (CAN) to invalidate all filters sampled on the channel(s) that fails this verification.

   Record displayed and actual flow rates on the monthly check sheet 402 or calibration sheet as required.

8.0 ROUTINE SERVICE CHECKS

8.1 General Information:

Perform the following checks on the SASS 22L Sampler at the intervals specified in the service schedule. The checks may be performed more frequently in harsh environments but should be performed at least at the prescribed intervals. Document all results and maintenance on the SASS 22L Monthly Quality Control Maintenance Check Sheet. Maintain a set of loaded test canisters solely for the purpose of leak and flow checks. Do not use actual sample canisters to perform leak and flow checks.

8.2 Daily Checks or after each sampling event:

Review event logs after each run to ensure proper operation of the SASS 22L sampler. Complete Custody and Field Sample Data sheet and return to lab with sampled cartridges. If any errors or warnings occur during a sampling event, download both summary logs and 5-minute data immediately following sample run to avoid data being overwritten.

8.3 Monthly Checks:

Complete the SASS 22L Monthly Quality Control Maintenance Check Sheet and include a hardcopy in the monthly data submittal packet.

Perform a time/date check. Compare SASS 22L date and time against an accurately set clock and adjust accordingly.

Perform a leak check. Use loaded leak/flow test canisters and SCC inlets during flow checks. The sampler display must read 0.1 LPM or less to pass. Refer to Section 7.7 for the leak check procedure.

Perform a flow rate verification for all channels in use. The flow rate must be 6.7 LPM ±4 percent (6.43-6.97 LPM) for channels 1-3 and 22.0 LPM ±4 percent (21.12-22.88 LPM) for channel 4. The flow checks must be done with loaded test canisters and SCC inlets in place. Refer to Section 7.6 for the flow verification procedure.

If a channel does not pass the flow verification that channel must be calibrated. The calibration procedure is outlined in the section 6.0, Calibration Procedures. In addition, field operators need to investigate when this problem started, and initiate a Corrective Action Notification (CAN) to invalidate all filters sampled on the channel(s) that fails this verification.

The temperature and pressure sensors must be checked monthly. The temperature sensors must be within ±2 °C of the temperature standard. The pressure sensor must be within ±10 mm Hg of the pressure standard. Refer to Sections 7.3-7.5 for the procedures. If any sensor is out of tolerance, perform a multi-point calibration or replace the faulty sensor.

Clean all SSC inlets monthly (Section 9.3).

The original Monthly Quality Control Maintenance Check Sheet must be retained onsite at the monitoring station in accordance to the standard CARB Documentation Policy, currently located in section 5.3 of the Quality Assurance Manual, Vol. 1.

8.4 Semi-Annual Checks:

Perform semi-annual verification/calibration of the external ambient temperature sensor, filter temperature sensor, pressure sensor, and volumetric flow controller (Channels 1 – 4), along with verifying the date and time are correct and it passes leak tests on all channels.

8.5 Annual Checks:

Replace channel 4 in-line filter, exhaust filter on the pump outlet, and filter on the release valve annually.

9.0 MAINTENANCE PROCEDURES

9.1 General Information:

Routine SASS 22L maintenance requires keeping the SASS 22L sampling head, pump box, inlet, and control unit dust free and clean.

9.2 Sampler Maintenance:

The control box, OT sensor shield, and pump box should be cleaned when required with a clean damp cloth. The sampling shield should be cleaned whenever canisters are changed to minimize chances for contamination and to maximize effectiveness of the radiation shield.

9.3 PM2.5 Sharp Cut Cyclone (SCC) Maintenance:

Clean the SCC inlet monthly. Remove the inlet from the sampling canister before cleaning. Remove the grit cup and clean with compressed air or a lint-free cloth. Disassemble the SCC and clean the inner chamber of the SCC with a lint-free cloth. Check all O-rings (grit cup, inlet head and body) for damage and replace if necessary. Use a small amount of silicon grease on O-rings if needed. Reassemble cyclone.

9.4 Pump Box Maintenance:

Clean and inspect the pump box once a quarter. Remove the four screws on the corners and lift the cover off the assembly. Clean the inside of the pump box with a brush or compressed air. Pay special attention to the screen located below the pump assembly. Replace the cover by first tightening the two screws on the fan exhaust side first, and then tighten the screws on the opposite end of the enclosure.

10.0 TROUBLESHOOTING

10.1 General Information:

The SASS 22L manual contains a table of symptoms and common solutions. Examining the event log data can be an important source of information when troubleshooting the SASS 22L unit.

10.2 Leak Check Failure:

Ensure that the canister and SSC are securely installed, along with confirming that the device used to block the flow works appropriately. If that channel still does not pass leak check criteria, try the following suggestions:

1. Disconnect the tubing from pump box. The flow for that channel should drop to 0.0 SLM. This indicates whether the leak is inside pump box or between pump and sample head.

2. If the pump fails leak, remove the lid, and try to isolate components backward by checking the easy connect, inline filters, and MFC connections. The inline filters are the most common source of leak especially if they were newly replaced.

3. If the leak is between pump and head, try to isolate components backward from SCC. Reconnect the tubing to pump. Remove the SCC and block at canister. If still failing, remove canister and leak check at head. If still failing, then the head is faulty which is very uncommon, check the O-ring on the vacuum line. If either of canister or SCC is failing, replace or lubricate all of O-rings and verify they are correctly assembled.

11.0 QUALITY CONTROL AND ASSURANCE

11.1 General Information:

To ensure that the ambient air monitoring data collected throughout California can be considered good quality data (data-for-record) and complies with procedures and regulations set forth by the U.S. EPA, CARB has a robust quality assurance program that includes several types of performance audit activities. SOPs ensure that quality control and quality assurance activities are conducted consistently and in accordance with program requirements. When instruments are found to be operating outside CARB's Performance Criteria, a corrective action notification (CAN) or Air Quality Data Action (AQDA) request may be issued.

11.2 Field Quality Control Criteria:

Field operator invalidation criteria for the SASS filter samples collected on the SASS 22L samplers are listed below. All samples collected in the field will be validated using these criteria. If a sample does not meet these criteria, the field operator will invalidate the sample. The operator must **record** the error on the PM2.5 Speciation Custody and Field Data Form in the comments section and clearly write "**INVALID**". A make-up sample should be scheduled (see Section 3.4 Make-up Guidelines). If more sampling canisters sets are needed, contact lab personnel to request additional sample media.

1. **CV** - If the CV > 2.1 percent, these must be noted, and the samples are invalid.

2. **Warnings** - If there are any Filter dT Warnings or Flow Warnings, these must be noted, and the samples are invalid.

3. **Start/Stop Times** – The sampler start and stop times must be midnight ± 30 minutes. Please note, that if the SASS indicates the sample began and stopped before 2330 hours or after 0030 hours, the samples are invalid.

4. **Sample Run Duration** – Sample run duration must be at least 23 hours and no more than 25 hours. Filter samples collected on samplers which operated for less than 23 hours or more than 25 hours, as documented the by elapsed time meter of the SASS, are invalid.

5. **Power Failure** – If a power failure during a sample run causes the stop time or sample run duration requirements (3 and 4 above) to be violated, the sample is invalid.

6. **Sample Flow Rate** – If during the monthly quality control flow verification, the samplers flow rate exceeds the acceptable flow range, field operators need to initiate a Corrective Action Notification [CAN] to invalidate all filters sampled on the channel(s) that fails this verification.

All samples are to be returned to the laboratory with the completed PM2.5 Speciation Custody and Field Data Form. If a sample(s) is invalid, the data form must indicate why the sample(s) is invalid.

11.3 Laboratory Quality Control Criteria:

Laboratory invalidation criteria for the SASS filter samples collected on the SASS 22L samplers are listed below. All samples collected returned from the field will be validated using these criteria. If a sample does not meet these criteria, the laboratory staff will invalidate the sample.

1. **Filter Contamination** – Filters ~~are~~ torn, damaged, or have become contaminated by any foreign matter (e.g., dirt, ink, liquids, etc.) are invalid.

2. **Shipping** - If sampling canisters are not shipped within 96 hours after sample retrieval, or return to the laboratory above 5 °C, the samples may be invalid.

3. **Report Form** – The filter is considered invalid if a PM2.5 Speciation Custody and Field Data Form is not included with the samples or the form is not completed. Laboratory staff should check returned sample shipping boxes thoroughly before considering a report form missing.

4. **Filter Leakage** – If the filter shows signs of air leakage due to a worn or improperly seated gasket, the sample will be invalidated.

Laboratory staff **will inform the field operator immediately** of any invalidations, allowing the field operator to perform a makeup sample.

11.4 Data Completeness:

If a sample is invalidated or the SASS 22L sampler does not operate as scheduled, a make-up sample run must be conducted as outlined in this SOP.

11.5 Flow Rate Verifications/Calibrations:

SASS 22L samplers used within the CARB network must undergo a verification/calibration at a minimum of once every six months. However, it is encouraged to conduct periodic flow rate checks more frequently.

11.6 Semi-Annual Flow Audits:

Semi-annual flow rate audits are not required for the SASS 22L samplers used within the CARB network.

12.0 REFERENCES

Met One Instruments, Inc., (2016) C-SASS Operation Manual, Model 82230 Addendum

Met One Instruments, Inc., (2001) Model SASS™ & SuperSASS™ PM2.5 Ambient Chemical Speciation Samplers Field Operation Manual

Standard Operating Procedure for the Filter and Canister Preparation for PM2.5 Speciation Samples (SOP MLD 062)

Quality Assurance Manual Volume I, Quality Management Plan for Ambient Air Monitoring

United States Code of Federal Regulations, Title 40 Part 58.

United States Code of Federal Regulations, Title 40 Part 50 Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM2.5 in the Atmosphere.

APPENDIX A - CARB MONTHLY QUALITY MAINTENANCE CHECK SHEET

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CALIFORNIA AIR RESOURCES BOARD
MONTHLY QUALITY MAINTENANCE CHECK SHEET
Met One Speciation Air Sampling System 22 LPM (SASS 22L)
PM-2.5 Speciation Sampler

Location:		Month/Year:	
Station Number:		Technician:	
Property Number:		Agency:	

Operator Instructions:

1) Each Run: Review event logs to ensure proper SASS 22L operation. Run field blanks as directed by the laboratory. Wipe down, with wet cloth, control box, OT sensor shield and pump box.
2) Monthly Checks: Submit SASS 22L Monthly Quality Control Maintenance Sheet. Clean SCC Inlets. Perform a leak check. Perform inlet flow checks. Perform temperature and pressure sensor checks. Check Date and Time.
3) Quarterly Checks: Clean and inspect pump box with brush or compressed air, especially the fan covers. Date last performed: _____
4) Semi-Annual Checks: Perform verification/calibration of the leak check, external ambient temperature sensor, filter temperature sensor, pressure sensor, and volumetric flow controllers. Date last performed: _____

Transfer Standard Used			
Make/Model	Serial Number/Bar Code	Component (T, P, Flow)	Date Certified

Date and Time Verification			
Sampler Display (PST) Date/Time	Transfer Standard (PST) Date/Time	Does Date Agree? Does Time Agree ± 2 min?	Action Taken

Leak Verification			
Channel Number	Leak Check Value	Agreement ≤ 0.1 LPM?	Action Taken and Recheck Results
1) Mass			
2) NO_3/SO_4			
3) Wood Smoke			
4) Carbon			

Temperature Verification				
Sensor Location	Sampler Display (°C)	Transfer Standard (°C)	Agreement within ± 2 °C?	Action Taken and Recheck Results
Ambient				
Filter				

Pressure Verification				
Sensor Location	Sampler Display (mm Hg)	Transfer Standard (mm Hg)	Agreement within ± 10 mm Hg?	Action Taken and Recheck Results
Ambient				

Flow Rate Verification					
Channel Number	Sampler Display (L/min)	Transfer Standard Display (L/min)	Design Flow Rate (L/min)	Agreement ± 4% 6.7 = 6.43-6.97 22.0 = 21.12-22.88	Action Taken and Recheck Results
1) Mass			6.7		
2) NO_3/SO_4			6.7		
3) Wood Smoke			6.7		
4) Carbon			22.0		
Comments:					

Reviewed By:_____Date:_____

AQSB QC Form 402 (SASS 22L) (4/2020)

APPENDIX B - AQSB CALIBRATION FORM 402

CARB Calibration Report- Met One SASS 22 LPM Sampler (DeltaCal)

ID Information:		Instrument :		Calibration:	
Station Name:	Chico-East	Make:	MetOne	"As Is"	X
AIRS #:	06-007-0008	Model #:	SASS 22 LPM	"Final"	
Station Address:	984 East Ave, Ste 4	Property #:	20202613	Calibration Date:	4/7/16
Station Number:	04-625	Serial #:	M2818	Report Date:	4/7/16
Operator:	Simoni	Agency:	CARB	Prev. Cal. Date:	1/27/16

Time:	Sampler:	Standard:
Date:	4/7/16	4/7/16
Hours: Minites: Secs	10:23:45 AM	10:21:00 AM

Flow Standard:	
Make & Model:	DeltaCal
Property #:	20103643
Cert. Date:	12/31/15
Cert. Exp:	12/31/16

Leak Test (LPM):	Pass? (≤0.1)
Channel 1	0.0
Channel 2	0.0
Channel 3	0.0
Channel 4	0.0

Temp (deg. C):	Sampler:	Standard:	Differ. from True:
Ambient	27.7	27.3	0.4
Filter	28.7	28.5	0.2

Pressure (mmHg):	Sampler:	Standard:	Differ. from True:
Ambient	751	751.5	-0.5

Raw Calibration Data

Volumetric Flow Test (LMP):	Sampler Display	Flow Transfer STD (VLPM)	Volumetric Flow vs. Design Flow (+/- percent)	Volumetric Flow vs. Sampler Display (+/- percent)
Channel 1 (Teflon)	6.7	6.70	0.4	0.00
Channel 2 (Nylon)	6.7	6.67	0.0	-0.45
Channel 3 (Teflon)	6.7	6.68	0.1	-0.30
Channel 4 (Quartz)	22.0	22.10	0.5	0.45

Comments:			
Calibrated by:	McKay	Checked by:	

AQSB Calibration Form 402 (DeltaCal)

APPENDIX C - PM2.5 SPECIATION CUSTODY AND FIELD DATA FORM

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LIMS #

$PM_{2.5}$ SPECIATION CUSTODY AND FIELD DATA FORM	Bar Code

CHAIN OF CUSTODY RECORD (INITIALS, DATE, TIME)	
Lab Out_____	Site Out_____
Site In _____	Lab In _____
Bin ID	Temperature at receipt (°C)

SITE INFORMATION	
Site Name _____	Date Sampler Loaded_____
Scheduled Sampling Day	Operator's Name

SAMPLER CHANNEL / CANISTER ASSIGNMENTS			
Channel #	Canister #	Canister Description	
1		Green - Teflon Filter - Mass / Metals	
2		Red - Nylon Filter - Ions	Denuder #
3		Orange - Teflon Filter - Wood Smoke	
4		Blue - Quartz Filter - Carbon	

START AND END INFORMATION			
Start Date	Start Time	End Date	End Time

RETRIEVAL INFORMATION		
Retrieval Date	Retrieval Time	Event Length

SAMPLER COLLECTION INFORMATION							
Channel #	Average Ambient P (mm Hg)	Sample Volume (M^3)	Ave. Ambient Temp (°C)	Flow CV (%)	Is CV Below 2%?	Mean Flow (L/min)	Flow Warning
1					Yes / No		Yes / No
2					Yes / No		Yes / No
3					Yes / No		Yes / No
4					Yes / No		Yes / No

	Ambient Temp (°C)	Ambient P (mm Hg)	Elapsed Time Warning	Filter dT Warning
Maximum			Yes	Yes
Minimum			No	No

Local Condition Codes (Circle One): Construction - Demolition nearby / Wildfire-Mexico / Fireworks / Farming-Highway Construction-Roofing Operations / High Pollen Count / High Winds / Infrequent Large Gathering / Prescribed Burn / Structural Fire / Seismic Activity / Wildfire - USA / NO UNUSUAL CONDITIONS

Comments

MASS ANALYSIS				
Weight	Mass (mg)	Duplicate Mass (mg)	Date	Analyst
Pre				
Post				

Start Post-Conditioning _____ 4/12/16