California Environmental Protection Agency

Air Resources Board

PROCEDURE FOR PREPARATION AND HANDLING OF AEROSOL SAMPLING MEDIA

SOP MV-AEROSOL-155
Version 1.1

Effective Date: June, 2014

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1. INTRODUCTION

One of the functions of the Aerosol Analysis and Methods Evaluation Section (AAMES) is to analyze aerosols from motor vehicle exhaust using six Standard Operating Procedures (SOPs). These include analyses for PM mass (SOP #145), organic and elemental carbon (SOP #139), water soluble ions (SOP #142), polynuclear aromatic hydrocarbons (SOP #144), and trace elements (SOP #152 and SOP #156). This SOP describes sample media handling processes which occur prior to and after the aerosol characterization SOPs are carried out and is part of the quality assurance (QA) and quality control (QC) program of the Chemical Analysis & Emissions Research Branch (CAERB).

2. SUMMARY

This standard operating procedure describes the assembly, disassembly, cleaning, and storage of sampling media packs used for aerosol sampling in vehicle emission tests.

Aerosol characterization is performed using a variety of sampling media which require different handling protocols. The flowchart in figure 1 outlines the media preparation techniques for the different analyses. After preparation and assembly the sampling media are submitted for sampling motor vehicle exhaust.

After vehicle test completion, the sampling media are returned to AAMES. Proper storage and subsequent disassembly procedures must be followed to preserve the integrity of the sample. The flowchart in Figure 2 summarizes the procedures for sample receipt and storage.

The components of the filter cassette must be thoroughly cleaned to ensure no cross contamination. The cleaning procedures for filter cassettes can be found in Figure 6.

If there are differences between the individual method SOP and this SOP, the method SOP supersedes this sample media preparation and handling SOP.

3. SAMPLING MEDIA AND SUPPLIES

Each analysis requires different sampling materials. The materials are listed as follows:

3.1. Gravimetric analysis - SOP #145
   a. Teflon, 2 µm pore size, 47 mm (Whatman PM2.5 filter (7592-104 PTFE) or equivalent).

3.2. Organic carbon and elemental carbon (OC/EC) analysis - SOP #139
   a. Quartz, 47 mm (Pall Corporation, Tissuquartz filter 2500QAO-UP, Ann Arbor, MI or equivalent).

3.3. Cations and anions by ion chromatography (IC) – SOP #142
   a. Teflon 2 µm pore size, 47 mm (Whatman PM2.5 filter (7592-104PTFE) or equivalent).
   b. Quartz fiber filters, 2500 QAT-UP, 47 mm (Pallflex, Putnam, CT or equivalent).

3.4. Polynuclear aromatic hydrocarbons (PAH) analysis - SOP #144
   a. Quartz fiber filter, glass fiber filter, and/or Teflon coated glass fiber filter such as Pallflex 7213 T60A20 Teflon
   b. PUF, polyurethane foam, 3.8 cm in diameter.
   c. XAD4, surface area: 725m^2/g and average pore diameter: 40A. Amberite

3.5. Trace elements by ICP/MS (Inductively Coupled Plasma Mass Spectrometer) – SOP #152
   a. Teflon 2 µm pore size, 47 mm (Whatman PM2.5 filter (7592-104 PTFE) or equivalent).

3.6. Trace elements by EDXRF (Energy Dispersive X-Ray Fluorescence) – SOP #156
   a. Teflon 2 µm pore size, 47 mm (Whatman PM2.5 filter (7592-104 PTFE) or equivalent).

3.7. Supplies
   a. 47 mm Delrin filter cassette with stainless steel (SS) screen (URG, URG-2000-30FL-BV-10)
   b. 70mm disposable Petri dish with cover (Falcon, 100 x 10 mm size or equivalent)
   c. Petri slides, 47 mm (Millipore, #PD15004700)
   d. Cassette separator
   e. Supportive screen (Dionex, ASE 300, 66 mL extraction cell)
   f. Flat-tipped tweezers (300 series stainless steel)
   g. Teflon tip tweezers
   h. Cartridge (Dionex, ASE 300, 66 mL extraction cell)

The cartridge is comprised of a stainless steel tube and cap. It is used as a sampling media holder for semi-volatile PAHs.

4. CHAIN OF CUSTODY

Chain of custody (COC) documentation ensures the integrity of the sampling media throughout the entire process. COC forms are created after the sampling media packs are assembled and ready for the emission tests.

The CAERB and emissions testing staff shall sign and date the COC before the sampling media packs are transported to the testing facility.

The COC lists barcodes corresponding to the sampling media being transported (see Figure 3). Any problems with the sampling media should be noted in this COC.

The CAERB and emissions testing staff shall sign and date the COC after the emission tests.

5. PREPARATION OF SAMPLING MEDIA

The preparation of sampling media must be carried out over a clean surface and laboratory personnel must wear powder free gloves. All sampling media holders such as Petri dishes, cartridges, and Petri slides must be labeled with barcoded labels.

5.1. Gravimetric analysis (SOP #145)

a. The lot number and filter ID range must be recorded.
b. Teflon filter preparation must be carried out in the weighing room.
c. Visually inspect Teflon filters for defects and discard defective filters.
d. Place the requested number of filters in a clean, sterile stainless steel container using stainless steel tweezers.
e. Place the lid on the container so there is a slight opening for conditioning to the room air.
f. Teflon filters must be conditioned for at least two weeks.
g. After the filters have been conditioned for two weeks, retrieve barcoded labels and Petri dishes.
h. Over a clean surface, label each Petri dish with barcode labels.
i. Use tweezers to place each filter into an individually barcoded Petri dish.
j. Load the requested number of Petri dishes containing the filters into air tight bags until they are pre-weighed.

5.2. Organic carbon and elemental carbon (OC/EC) analysis (SOP #139)

a. Quartz filters must be pre-fired to remove any traces of carbon compounds before use.
b. Visually inspect all quartz filters for discard defective filters.
c. Place a batch of inspected filters on Coors porcelain plates using tweezers.
d. Place the porcelain plates and filters inside the oven.
e. Set the oven to heat to 900ºC.
f. When oven temperature has reached 900ºC, continue baking the quartz filters for four hours (CAUTION: Do not open the hot furnace door as this can cause serious bodily injuries).
g. Set oven temperature to room temperature and let the oven and filters cool down to room temperature.
h. Label each Petri slide with barcode labels.
i. Remove porcelain plates with the filters from the oven. Remove filters with tweezers and place each filter into an individually labeled filter container. Be careful not to damage any filters.
j. Place the filters and containers in a desiccator or a refrigerator for storage until use.
k. Select a random filter analyze for OC and EC concentrations. The quartz fiber filter must have OC < 1.0 $\mu gC/cm^2$ and EC < 0.20 $\mu gC/cm^2$. If the carbon concentrations are over the above limits, analyze one more filter. If the second filter also has carbon concentrations over these limits, all filters from the batch must be discarded.

5.3. Cations and anions by IC (SOP #142)

a. Visually inspect Teflon filters for defects and discard defective filters.
b. Immediately assemble into sampling media packs.

c. Save at least one filter for every batch, to use as a filter-blank.

5.4. Polynuclear aromatic hydrocarbons (PAH) analysis (SOP #144)

a. Filters for PAH analysis are pre-cleaned with dichloromethane (DCM) via Soxhlet extraction prior to sample collection.
b. Load the filters in the cleaned Soxhlet extraction tube and clean the filters according to the procedure listed in SOP # 144 Section 9.1.
c. Remove the extraction tube. Purge the filters at room temperature with nitrogen gas till dry. Store the cleaned and dried filters in a refrigerator (at ~4°C).
d. Assemble dry filters into sampling media packs following the procedures in section 6.5.
e. The PUF is cleaned with DCM by Accelerated Solvent Extraction (ASE) methods following the conditions listed in section 9.2 of SOP #144.
f. Store the cleaned PUF in a sealed container for later use.
g. The XAD4 is cleaned in methanol and DCM via ASE following SOP #144 section 9.3 and stored in a sealed container.
h. Use vacuum oven at a reduced pressure to remove residual solvent at ~ 40ºC. Store the XAD4 in a sealed container for later use.

5.5. Trace elements by ICP/MS (SOP #152)

a. Visually inspect Teflon filters for defects and discard defective filters.
b. Immediately assemble into sampling media packs.
c. Save at least one filter for every batch, to use as a filter-blank.

5.6. Trace elements by EDXRF (SOP #156)

a. Visually inspect Teflon filters for defects and discard defective filters.
b. Immediately assemble into sampling media packs.
c. Save at least one filter for every batch, to use as a filter-blank.

6. ASSEMBLING SAMPLING MEDIA PACKS

The assembly of sampling media packs must be carried out in a clean environment and wearing powder free gloves. All equipment and supplies used must be clean. The procedures for cleaning the filter cassettes with stainless steel (SS) screens and PAH cells are listed in section 9.

6.1. The emissions testing facility may request unassembled filters. In this case, filters must be prepared and individually placed into barcoded Petri dishes. The requested number of Petri dishes containing the sampling media are placed in air tight bag and stored in the designated area.

6.2. Assembly of Teflon filter cassette for gravimetric analysis

a. The assembly must be carried out in the weighing room.

b. Only pre-weighed filters are to be used when assembling sampling media packs. Each filter is stored in a barcoded Petri dish.
c. Use tweezers to place a SS screen on the top part of the bottom ring of the filter cassette.
d. Use tweezers to carefully lay a filter on the SS screen by touching only the plastic rim of the filter.
e. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
f. The setup of the sampling media pack is shown in Figure 4.
g. Place the sampling media pack in the original barcoded Petri dish.
h. Load the requested number of Petri dishes containing the sampling media packs in air tight bag.
i. Create a COC.
j. Store the packs in the weighing room until collected by emissions testing staff.

6.3. Assembly of quartz filter cassette for OC/EC

a. Locate labeled filter containers which contain the pre-fired quartz filters. The setup of the sampling media pack is shown in Figure 5.
b. Use tweezers to place a SS screen inside the bottom ring of the filter cassette.
c. Use tweezers to place a drain disc on the SS screen.
d. Use tweezers to carefully lay a filter on the drain disk by touching only the edge of the filter.
e. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
f. Locate a barcode label and label a Petri dish. (Note: The barcode and barcode number must be identical to the number on the Petri slide.)
g. Place the sampling media pack in a barcoded Petri dish.
h. Load the requested number of the Petri dishes containing sampling media packs in an air tight plastic bag with the Quartz Filter Custody Transfer Sheet and barcode labels for the Chain of Custody record.

i. Store the packs on the designated table for the emissions testing staff to collect for use in testing.

6.4. Assembly of Teflon filter cassette for IC,

a. The setup of the sampling media pack is shown in Figure 4.
b. Locate a barcode label and label a Petri dish.
c. Use tweezers to place a SS screen inside the bottom ring of the filter cassette.
d. Use tweezers to carefully lay a Teflon filter on the SS screen by touching only the edge of the filter.

e. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
f. Place the sampling media pack in the Petri dish.
g. Load the requested number of Petri dishes containing the sampling media pack in air tight bag.
h. Create a COC.

6.5. Assembly of filter cassette for PAH analysis
a. Locate a barcode label and label a Petri dish.
b. Use tweezers to place a SS screen inside the bottom ring of the filter cassette.
c. Use tweezers to carefully lay a filter on the SS screen by touching only the edge of the filter.
d. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
e. Place the sampling media pack in the Petri dish.
f. Load the requested number of Petri dishes containing the sampling media pack in air tight bag.

6.6. Assembly of sampling cartridge for semi-volatile PAHs analysis
a. Label a stainless steel tube with barcoded labels.
b. Insert a piece of PUF at one end of the tube. Make sure it is evenly covering the opening completely.
c. Cap this end of the stainless steel tube.
d. Let it sit on the cap with the other end open facing up.
e. Load the desired amount of XAD4.
f. Use tweezers to insert a piece of PUF through the open end. Again make sure the PUF is evenly covering the opening.
g. Cap this end.
h. Load the requested number of cartridges in an air tight bag or container.
i. Store the air tight bags containing the cartridges in clean area within laboratory with COC and barcode label until they are collected by the emissions testing staff.
j. The sampling media and sampling media holder are pictured in Figure 7.

6.7. Assembly of Teflon filter cassette for ICP/MS
a. The setup of the sampling media pack is shown in Figure 4.
b. Locate a barcode label and label a Petri dish.
c. Use tweezers to place a SS screen inside the bottom ring of the filter cassette.
d. Use tweezers to carefully lay a Teflon filter on the SS screen by touching only the edge of the filter.
e. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
f. Place the sampling media pack in the Petri dish.
g. Load the requested number of Petri dishes containing the sampling media pack in air tight bag.
h. Create a COC.

6.8. Assembly of Teflon filter cassette for EDXRF

a. The setup of the sampling media pack is shown in Figure 4.
b. Locate a barcode label and label a Petri dish.
c. Use tweezers to place a SS screen inside the bottom ring of the filter cassette.
d. Use tweezers to carefully lay a Teflon filter on the SS screen by touching only the edge of the filter.
e. Place the top part of the filter cassette and use finger tips to snap the top and bottom ring of the filter cassette together.
f. Place the sampling media pack in the Petri dish.
g. Load the requested number of Petri dishes containing the sampling media pack in air tight bag.
h. Create a COC.

7. TRANSPORTING AND STORING SAMPLING MEDIA

7.1. The Petri dish with sampling media pack must be transported in an air tight plastic bag along with the COC. The emissions testing staff receiving the sampling media packs must check the sample IDs and sign the COC accounting for the filter received.

7.2. After the vehicle emissions test has been completed, the emissions testing staff shall place the sampling media packs in the corresponding Petri dish (to ensure the same sample ID throughout the tests) and placed back into an air tight bag.

7.3. Emissions testing staff shall return the sampling media packs to AAMES staff along with a completed COC filled out with the vehicle testing information. Once the sampling media packs have been received, the sampling media packs must be placed in the designated area as listed below:

a. For gravimetric analysis, sampling media must be placed in the weighing room.
b. For OC/EC, IC, PAH, and EDXRF, sampling media must be refrigerated immediately.
c. For ICP/MS, sampling media must be stored in a clean area.

7.4. Sampling media packs should remain in Petri dishes, inside the air tight bag, and in the designated area stated above until they are disassembled.

7.5. If the sampling media cannot be immediately stored in the designated area, then the sampling media may be temporarily stored in a clean environment.

8. DISASSEMBLING SAMPLING MEDIA FOR ANALYSIS

8.1. Sample media disassembling for gravimetric analysis

a. Sample media packs are typically disassembled in the weighing room within 2 weeks of being received from the testing facility.
b. To disassemble the sampling media pack, place the filter cassette in the cassette separator.

c. Gently slide the filter cassette down the groove to loosen the top and bottom rings of the filter cassette. If necessary, pry the two rings apart. Avoid any contact with the membrane of the filter.
d. Gently push up the SS screen.
e. Use tweezers to carefully remove the Teflon filter by touching only the rim of the filter. Avoid any contact with the membrane of the filter.
f. Load the Teflon filter back to its corresponding Petri dish.
g. Filter cassette parts are removed from the weighing room and will go through the cleaning procedure as listed in section 9.1.

8.2. Disassembly of quartz filter cassettes for OC/EC

a. The disassembling of sampling media packs must be carried out in a clean environment and while wearing powder free gloves.
b. To dissemble the sampling media pack, place the filter cassette in the cassette separator.
c. Gently slide the filter cassette down the groove to loosen the top and bottom pieces of the filter cassette. If necessary, pry the two rings apart.
d. Gently push up the SS screen.
e. Use tweezers to carefully remove the filter by touching only the edge of the filter. Avoid any contact with the membrane of the filter.
f. Load the filter back to its corresponding filter container (i.e. Petri dish or Petri slide).
g. The filter cassette rings and SS screens will go through the cleaning procedure as listed in section 9.1.
h. Drain disks must be stored in a clean container

8.3. Disassembly of Teflon filter cassettes for OC/EC

a. The disassembling of sampling media packs must be carried out in a clean environment and while wearing powder free gloves.
b. To dissemble the sampling media pack, place the filter cassette in the cassette separator.
c. Gently slide the filter cassette down the groove to loosen the top and bottom pieces of the filter cassette. If necessary, pry the two rings apart.
d. Gently push up the SS screen.
e. Use tweezers to carefully remove the filter by touching only the edge of the filter. Avoid any contact with the membrane of the filter.
f. Load the filter back to its corresponding filter container (i.e. Petri dish or Petri slide).
g. The filter cassette rings and SS screens will go through the cleaning procedure as listed in section 9.1.

8.4. Sample media disassembling for Particle-bound PAHs

a. Over a clean environment and wearing powder free gloves, place the filter cassette in the cassette separator.
b. Gently slide down the groove to loosen the top and bottom rings of the filter cassette. If necessary, pry the two rings apart.

c. Use a finger to gently lift up the SS screen.
d. Use tweezers to carefully remove the filter by touching only the edge of the filter.
e. Place the sample filter in the cell with tweezers. Avoid direct contact between the tweezers and the sample collection side of the filter.
f. Proceed to the extraction procedures listed in SOP #144 section 11.1.

8.5. Sample media disassembling for Semi-volatile PAHs
a. No disassembly is required.
b. The cartridges with the PUF/XAD/PUF configuration can go on to the extraction procedure listed in SOP #144.

8.6. Disassembly of Teflon filter cassettes for ICP/MS
a. The disassembling of sampling media packs must be carried out in a clean environment and while wearing powder free gloves.
b. To dissemble the sampling media pack, place the filter cassette in the cassette separator.
c. Gently slide the filter cassette down the groove to loosen the top and bottom pieces of the filter cassette. If necessary, pry the two rings apart.
d. Gently push up the SS screen.
e. Use tweezers to carefully remove the filter by touching only the edge of the filter. Avoid any contact with the membrane of the filter.
f. Load the filter back to its corresponding filter container (i.e. Petri dish or Petri slide).
g. The filter cassette rings and SS screens will go through the cleaning procedure as listed in section 9.1.
h. Drain disks must be stored in a clean container.

8.7. Disassembly of Teflon filter cassettes for EDXRF
a. The disassembling of sampling media packs must be carried out in a clean environment and while wearing powder free gloves.
b. To dissemble the sampling media pack, place the filter cassette in the cassette separator.
c. Gently slide the filter cassette down the groove to loosen the top and bottom pieces of the filter cassette. If necessary, pry the two rings apart.
d. Gently push up the SS screen.
e. Use tweezers to carefully remove the filter by touching only the edge of the filter. Avoid any contact with the membrane of the filter.
f. Load the filter back to its corresponding filter container (i.e. Petri dish or Petri slide).
g. The filter cassette rings and SS screens will go through the cleaning procedure as listed in section 9.1.

9. CLEANING SAMPLING MEDIA HOLDERS

Sampling media holders include filter cassette and PAH cartridges. Filter cassettes with SS screens and PAH cells must be cleaned before assembling. Filter cassettes and SS screens used for gravimetric analysis must be stored in the weighing room. A flow chart of the procedure starting with the disassembling of the sampling media packs is shown in Figure 6.

9.1. Filter cassette with SS screen

a. Separate the parts of the sample media pack into three piles: top part of the filter cassette, bottom part of the filter cassette, and SS screen.
b. Place the bottom and top parts of the filter cassette in different mesh bags for washing then place the bags in an automatic washing machine with a residue-free detergent.
c. Remove from washing machine and cover.
d. Allow the filter cassette parts to air dry.
e. Place the SS screens between sterile plastic meshes in a sealed container. Make sure not to load too many SS screens and meshes together.
f. Sonicate the SS screens at least twice for an hour in hot DI water.
g. Rinse the metal SS screens with DI water at least three times after every sonication.
h. Separate the SS screen and allow to air dry in an enclosed receptacle.
i. Once dry, place the filter cassette parts and SS screens in a clean environment.

9.2. PAH cartridges

a. ASE Extractor Cell (PAH cartridge) cleaning
   - Inspect the integrity of the extraction cell, such as the Teflon O-ring. Replace the seals when necessary.
   - Disassemble the cell by removing the cap.
   - Clean the cells parts by sonicating with DI water for 30 minutes and rinse with acetone and dichloromethane (DCM).
   - Air dry the cell parts or oven dry at 100ºC.
   - New Cell disposable filters can be cleaned with DCM via Soxhlet extraction.
   - Sonicate the borosilicate glass balls (cell fillings) with DI water in a clean beaker for at least 30 minutes. Discard and drain the waste water.
   - Repeat the sonicating procedure with DI water for the second time.
   - Rinse the borosilicate glass balls starting with DI water, followed by acetone, hexane, and dichloromethane. Air dry or oven dry at 100ºC in a PAH contamination free environment.
b. Glassware cleaning
   - Wash with detergent (Extran AP12. residue free or equivalent) and rinse with DI water during washing cycles in a washing machine.
   - Rinse the washed glassware at least three times with acetone, hexane and dichloromethane, in that order.
   - Dry the cleaned glassware in an oven at approximately 100 ºC.
c. Soxhlet extractor cleaning
   - Rinse the washed glassware at least three times with acetone, hexane and dichloromethane, in that order.
   - Dry the cleaned glassware in an oven at approximately 100 ºC.

10. QUALITY ASSURANCE AND QUALITY CONTROL

Sampling media must be prepared and handled in a clean environment. Powder free gloves must be worn when handling preparing and handling sampling media. Filters must be directly handled with tweezers.

All sampling media will be manually inspected before undergoing analysis. If there are any tears, scratches, or pinholes found on the filters before sample collection, the filter shall be discarded.

Should the membrane portion of the filters contact a contaminated surface, such as a laboratory countertop or fume hood dash, the filter metals results should be flagged as possibly contaminated.

If filter irregularities are found after sample collection, senior staff shall be consulted. All filter irregularities must be recorded.

For gravimetric analysis, should the particulate matter on the filters contact the Petri dish, tweezers, microbalance or any other surface, the data with respect to that filter is void and the record is registered.

Pre-fired filters used in OC/EC analysis must meet the following criteria: OC < 1.0 $\mu gC/cm^2$ and EC < 0.2 $\mu gC/cm^2$.

11. REFERENCES

11.1. Procedure for Organic Carbon and Elemental Carbon (OC/EC) Analysis of Vehicular Exhaust Particulate Matter (PM) on Quartz Filters. SOP MV-AEROSOL-139
http://www.arb.ca.gov/testmeth/slb/sop139v1_1.pdf

11.2. Procedure for Analysis of Particulate Anions and Cations in Motor Vehicle Exhaust by Ion Chromatography. SOP MV-AEROSOL-142
http://www.arb.ca.gov/testmeth/slb/sop142v2-0.pdf

11.3. Procedure for the Determination of Polynuclear Aromatic Hydrocarbons in Particulate Matter using Gas Chromatography/ Mass Spectrometry. SOP MV-AEROSOL-144
http://www.arb.ca.gov/testmeth/slb/sop144v1-0.pdf

11.4. Procedure for the Determination of Particulate Matter (PM) Mass Collection on Filters. SOP MV-AEROSOL-145
http://www.arb.ca.gov/testmeth/slb/sop145v5_1.pdf

11.5. Procedure for the Determination of Trace Elements in Particulate Matter Emitted from Motor Vehicle Exhaust using Inductively Coupled Plasma Mass Spectrometer (ICP-MS). SOP MV-AEROSOL-152

http://www.arb.ca.gov/testmeth/slb/sop152.pdf

11.6. Procedure for Determining the Composition of Elements in Particulate Matter from Motor Vehicle Exhaust by Energy Dispersive X-Ray Fluorescence (EDXRF) Spectroscopy. SOP MV-AEROSOL-156
http://www.arb.ca.gov/testmeth/slb/sop156.pdf

12. REVISION HISTORY

12.1. Version 1.0 was effective starting December, 2013.

12.2. Version 1.1

a. The SOP name Change from SOP NO. MLD 155 to SOP MV-AEROSOL-155;
b. Incorporates the filter preparation and handling procedures for the analysis of trace elements via EDXRF, following the SOP MV-AEROSOL-156;
c. Includes minor editorial changes;
d. Separately describes operations for IC, ICP/MS, and ED-XRF.

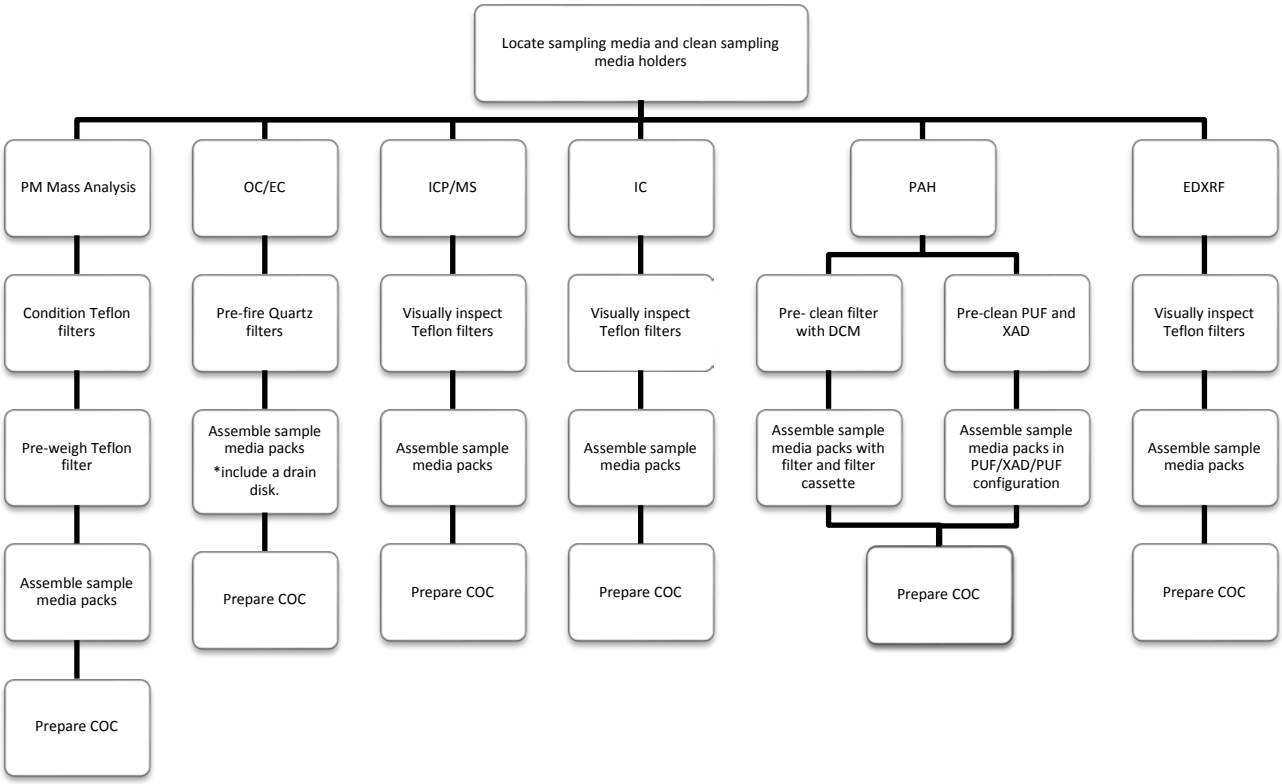

Figure 1: Flowchart for sampling media preparation

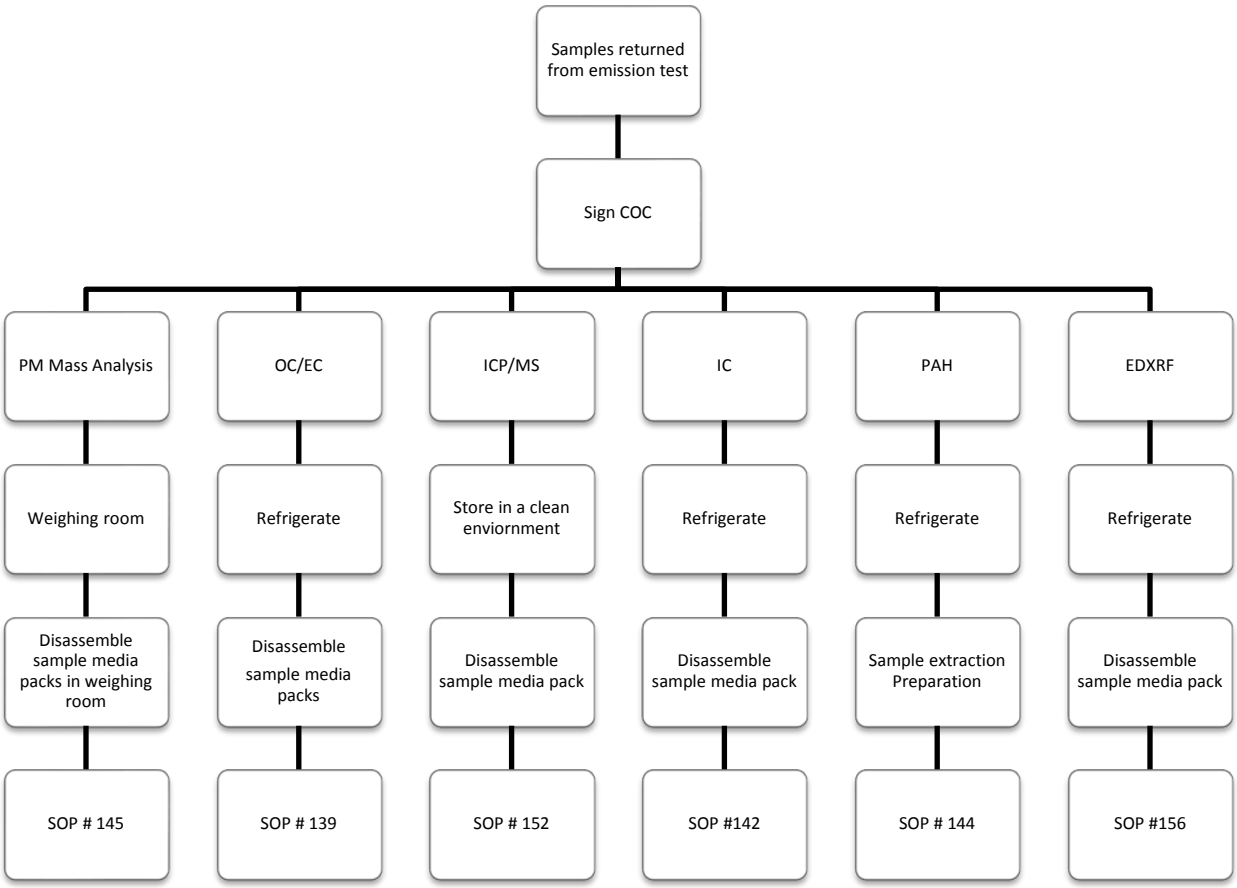

Figure 2: Sample receiving and storage procedures

SLB Chain of Custody for PM Mass

Client/Project: 2R1305 Site/Location/Dyno: 7

Sample ID (barcode)	Vehicle Test Information	Comments
100016968	2R1305 36-EC1-04 08-12-2014 Test ID 1039396 FFP___ SPC__ Quad A___ B___ C___ D___	Trip Blank
100017743	2R1305 36-EC1-04 08-12-2014 Test ID 1039396 FFP___ SPC__ Quad A___ B 1 C___ D___	
100017744	2R1305 36-EC1-04 08-12-2014 Test ID 1039396 FFP___ SPC__ Quad A___ B 2 C___ D___	
100017745	2R1305 36-EC1-04 08-12-2014 Test ID 1039396 FFP___ SPC__ Quad A___ B 3 C___ D___	
100017746	2R1305 36-US1B-04 08-12-2014 Test ID 1039397 FFP___ SPC__ Quad A___ B 1 C___ D___	
100017747	2R1305 EC1-TB Aug 12, 2014 Test ID 707962 FFP___ SPC__ Quad A A2 B___ C___ D___	

Used 22

Unused Ø

General comments about test: 22 filters total-NROD

Filters Delivered By AAMES: NROD Date: 8/11/14

Filters Received By Dyno: H.T. D7 Date: 8-11-14

Filters Returned By Dyno: 7 MC. Date: 8-15-14

Filters Received By AAMES: NROD Date: 8-15-14

Figure 3: Chain of Custody (COC) for gravimetric analysis

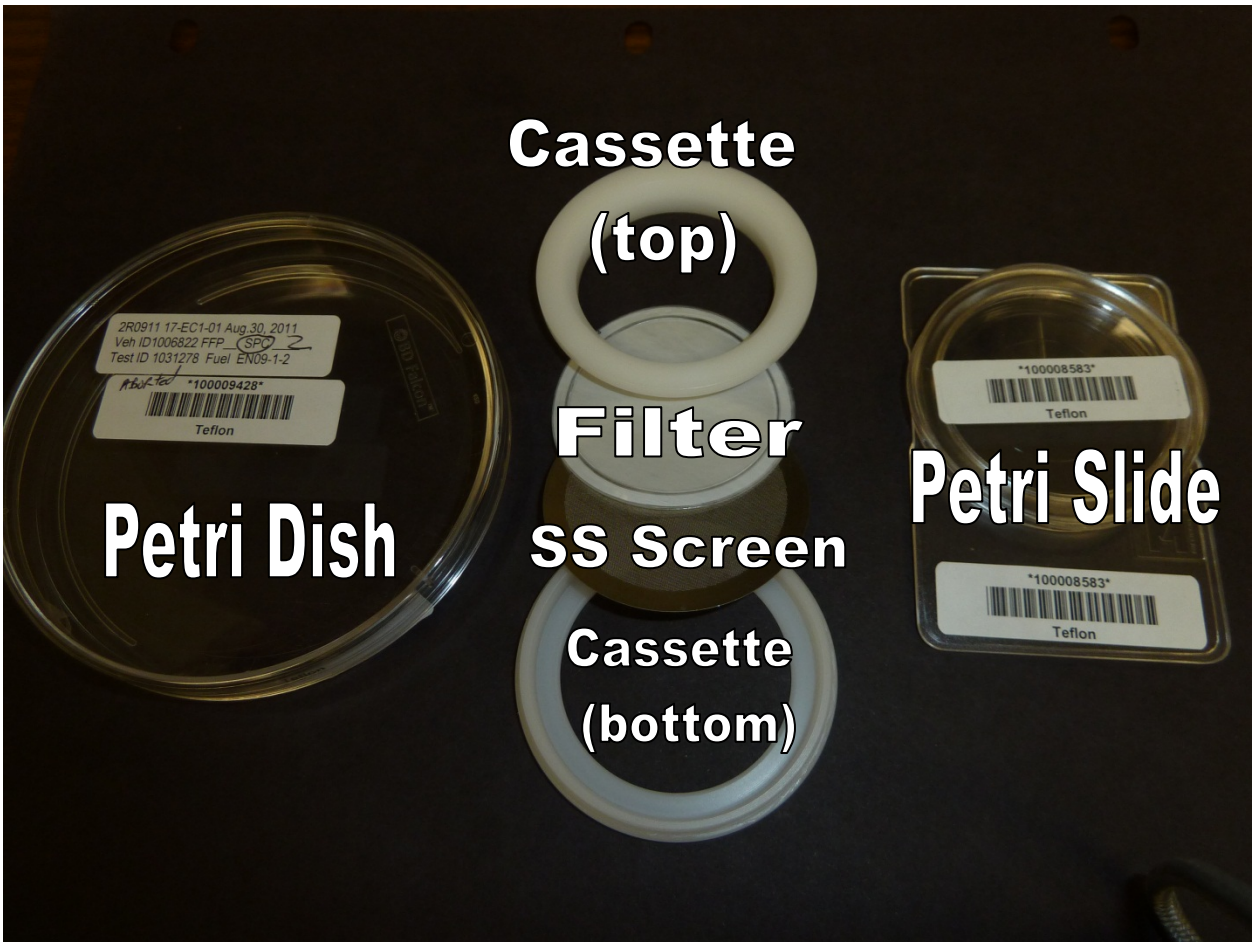

Figure 4: Teflon filter assembly

Figure 5: Quartz filter assembly

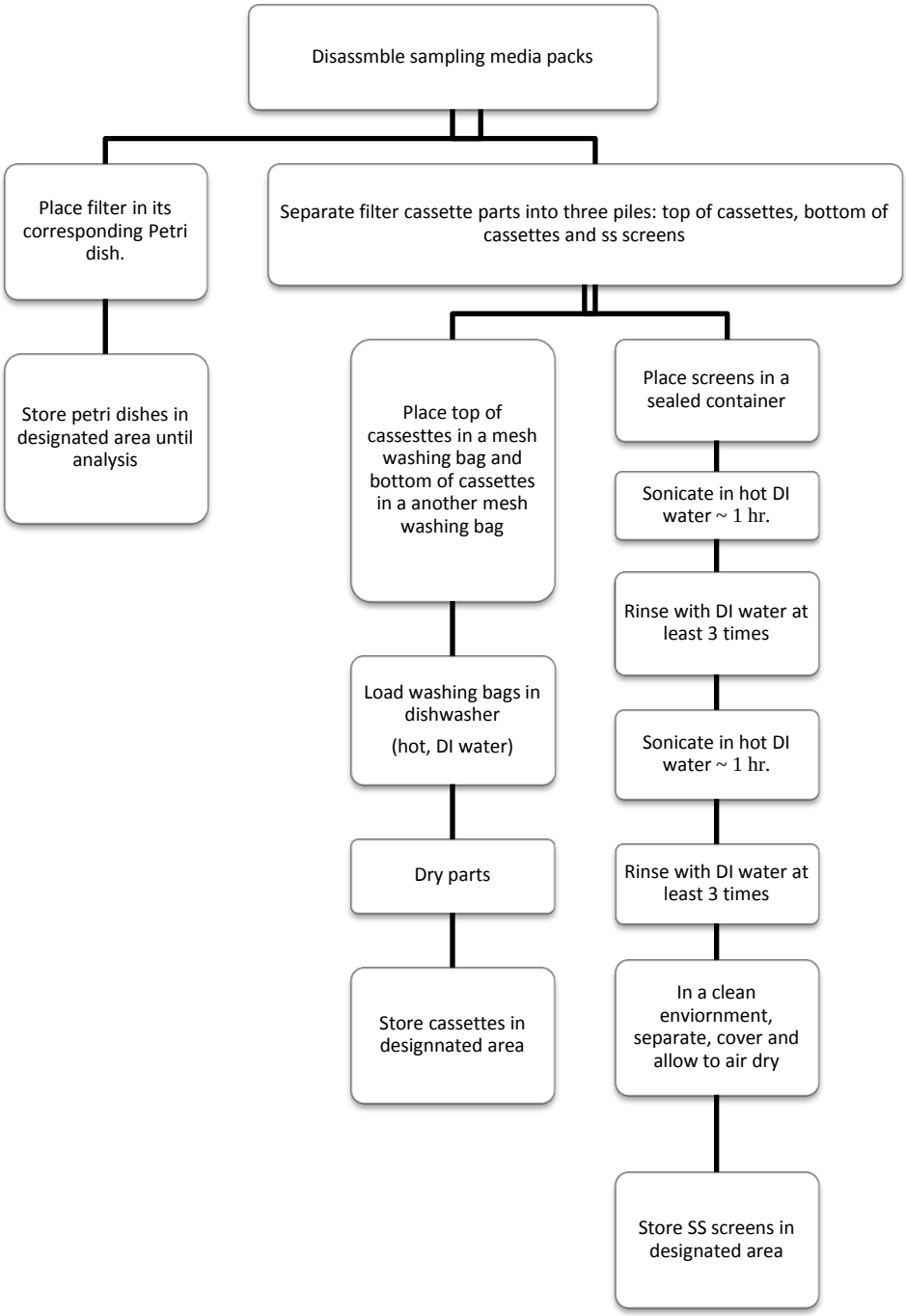

Figure 6: Cleaning procedures for sampling media holders used in gravimetric analysis, IC, ICP/MS, OC/EC, and EDXRF

Figure 7: Sampling media holder for the collection of the semi-volatile PAHs