STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services 2890 Woodbridge Avenue Building 209 Annex Edison New Jersey 08837-3679
STANDARD OPERATING PROCEDURE

Title: SUMMA Canister Sampling	
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History	Effective Date
Supersedes: SOP #1704, Revision 0.1, 07/27/95	11/16/15
Revised entire document to include both grab and time-weighted sampling	
Added additional test about the UFP-QAPP to 1.0 Scope and Application	
Expanded the data validation section to include data verification	
Removed Figure 1	

CONTENTS

SUPERSEDES: SOP #1704; Revision 0.1; 07/27/95, US EPA Contract No. 68-C4-0022

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe a procedure for sampling of Volatile Organic Compounds (VOCs) in ambient air. The method is based on samples collected as whole air samples in SUMMA or equivalent passivated stainless steel canisters. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass-selective detector or multi-detector techniques. This method presents procedures for sampling into canisters at final pressures below atmospheric pressure referred to as sub-atmospheric pressure sampling.

This method is applicable to specific VOCs and a limited set of other compounds that have been tested and determined to be stable when stored in subatmospheric pressure canisters. The volatile organic compounds that have been successfully collected in canisters by this method along with their reporting limits are listed in Appendix A. These compounds results are reported as parts per billion by volume (ppbv) and micrograms per meter cubed ($\mu g/m^3$).

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Subatmospheric pressure sampling uses an initially evacuated canister and mass flow controller to regulate flow. With this configuration, a sample of air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into a pre-evacuated SUMMA canister. Alternatively, subatmospheric pressure sampling may be performed using a fixed orifice, capillary or adjustable micro-metering valve in lieu of the mass flow controller arrangement for taking grab samples or time-integrated samples. Grab samples are typically collected during discrete odor events. For grab sampling, the canister value is opened, and the vacuum inside the canister draws in an air sample in a few seconds. Time-integrated sampling is conducted over a specific period of time to acquire a specific volume of air. The most common use is for the collection of sub-slab soil gas, indoor and ambient air samples associated with vapor intrusion activities.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

Sample holding times must be determined prior to initiating field activities and are dependent on the compound (s) being analyzed. Canisters and orifices should be stored in a cool dry place and always be placed in their plastic/metal shipping boxes during transport and storage to protect the canisters from dents and/or punctures during transport.

Typically 6-liter (L) passivated canisters are used for vapor intrusion and/or odor events although 1-L canisters may also be used. After the air sample is collected, the canister valve is closed, an identification tag is attached to the canister and the canister is transported to a laboratory for analysis. Upon receipt at the laboratory, the canister tag data are recorded.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Contamination may occur in the sampling system if canisters are not properly cleaned before use. Additionally, all other sampling equipment (e.g. flow controllers) must be thoroughly cleaned. Instructions for cleaning the SUMMA canisters and flow controllers are described in the Scientific, Engineering, Response and Analytical Services (SERAS) SOP #1739, *Procedures for SUMMA Canister and Flow Controller Cleaning*,

Care must be used with canister valves. Do not overtighten the valves.

Ambient air sampling during rainy weather may result in clogging of the flow controller filter causing reduction or stoppage of flow. Sampling during rainy weather should be avoided.

5.0 EQUIPMENT/APPARATUS

- Sampling inlet line (optional) - Teflon tubing to connect the sampler to the environment being sampled (e.g. sub-slab, ambient)
- SUMMA canister, Restek Corporation, PA, Model # 27420 or 27408 or equivalent - leak-free stainless steel pressure vessels of desired volume with valve and electropolished interior surfaces, certified clean by the laboratory for the analytes of interest and leak checked
- (Optional) Particulate matter filter, Swagelok, OH, Model SS-2F-K4-2 or equivalent - 2-µm sintered stainless steel in-line filter.
- Mass flow controller, fixed orifice, capillary or adjustable micro-metering valve, Valco Instruments, TX, VICI Model 202 or equivalent - for grab samples or time-integrated samples.
- Vacuum gauge, certified annually, to record canister vacuum in inches of mercury
- Flow meter, accompanied by an annual certificate of analysis, to verify orifice flow rates (ADM3000 or equivalent)
- Wrench, 9/16”

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURE

7.1 Grab Sample Collection

A canister, which is evacuated to one atmosphere below ambient and fitted with a flow restricting device, is opened to the atmosphere containing the VOCs to be sampled. The pressure differential causes the sample to flow into the canister. This technique may be used to collect grab samples (duration of seconds). The typical steps for collecting a grab sample are as follows:

1. With a 9/16″ wrench, remove the brass fitting from the top of the canister.

2. Attach the vacuum gauge to the canister and open the canister valve.

3. Verify and record the “Initial” reading of the evacuated SUMMA canister. The evacuated canister should read no more than -29.5 inches (") of mercury.

4. Ensure that the canister valve is fully closed before removing the vacuum gauge.

5. Place the SUMMA canister in desired location. If sampling from a vapor stream, connect inert tubing to canister sampling port.

6. Open sampling valve by turning knob counter clockwise until the knob moves easily.

7. An audible “hiss” may indicate that sampling has initiated. When the hissing stops, close valve and replace cap. Sample duration should be approximately 10 to 30 seconds.

8. Document sample collection information on the Air Sampling Worksheet (Appendix B)

7.2 Time-Weighted Average Collection

This technique may be used to collect time-integrated samples (duration of 1 to 24 hours). The sampling duration depends on the degree to which the flow is restricted.

1. With a 9/16” wrench, remove the brass fitting from the top of the canister.

2. Attach the vacuum gauge to the canister and open the canister valve.

3. Verify and record the “Initial” reading of the evacuated SUMMA canister. The evacuated canister should read no more than -29.5 "of mercury.

4. Ensure that the canister valve is fully closed before removing the vacuum gauge.

5. Check the flow rate of the orifice using a certified flow meter or a rotameter that has been checked against the primary flow meter.

6. Attach the flow controller to the top of the canister. Start the fitting by hand to avoid cross threading, then tighten firmly with a 9/16" wrench.

7. Open the valve on the canister counter clockwise and record the “start” time.

8. Monitor sampling progress periodically.

9. At the end of the sampling period, close the valve on the canister by turning clockwise until hand tight. Record the “end” time. While the ideal reading on the can gauge should be slightly negative, the actual can pressure will be tested with a calibrated gauge at the laboratory.

10. Remove the flow controller and put it into its appropriate shipping container.

11. Replace the brass fitting on top of the canister.

12. Record the final vacuum of the canister and complete the Air Sampling Worksheet - SUMMA Canister.

8.0 CALCULATIONS

A flow control device is chosen to maintain a constant flow into the canister over the desired sample period. This flow rate is determined so the canister is filled to about 5-L in a 6-L-canister for sub-atmospheric pressure sampling over the desired sample period. The flow rate can be calculated by:

$$F = \frac{(P)(V)}{(T)(60)}$$

where:

F = flow rate (*cc*/min)
P = final canister pressure, atmospheres absolute (1 for atmospheric, non-pressurized sampling)
V = volume of the canister (cm^3)
T = sample period (hours)

$$F = \frac{(5000)}{(24)\,(60)} = 3.5\text{cc / min}$$

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific QA/QC activities that apply to the implementation of these procedures will be listed in the Quality Assurance Project Plan prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All SUMMA canister sampling data, including the items listed in Section 10 must be documented in site logbooks or on field data sheets.

2. All equipment must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the QAPP. Equipment check-out and calibration is necessary prior to sampling and must be done according to the instruction manuals supplied by the manufacturer. The vacuum inside each canister must be checked prior to use to ensure no leaks have occurred. The pre-set flow rates set by the laboratory are checked prior to use to ensure that the proper volume of sample will be collected.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: Location, Sub-location, SUMMA ID number, orifice ID number, start and end pressures, NIST vacuum gauge ID number, flow rate, flow meter ID number, start and end times. These data are essential to providing an accurate and complete final deliverable. The SERAS Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Safety and Health Administration (OSHA) or ERT/SERAS health and safety guidelines. More specifically, depending upon the site-specific contaminants, various protective programs must be implemented prior to some SUMMA canister sampling activities. The site health and safety plan (HASP) must be reviewed with specific emphasis placed on the protection program planned for the sampling activities. Standard operating procedures should be followed such as minimizing contact with potential contaminants in the vapor phase through the use of respirators and disposable clothing.

12.0 REFERENCES

EPA Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry Analysis (GC/MS)*, January 1999.

13.0 APPENDICES

A - Typical Reporting Limits for Volatile Organic Compounds
B –Air Sampling Worksheet - SUMMA Canister

APPENDIX A
Typical Reporting Limits for Volatile Organic Compounds
SOP #1704
November 2015

Typical Reporting Limits for Volatile Organic Compounds

Analyte	MW	CAS Number	Reporting Limits	
			ppbv	µg/m^3
Acetone	58.08	67-64-1	0.200	0.475
Benzene	78.11	71-43-2	0.020	0.064
Bromoform (Tribromomethane)	252.73	75-25-2	0.020	0.207
Bromomethane	94.94	74-83-9	0.020	0.078
2-Butanone (MEK)	72.11	78-93-3	0.020	0.059
1,3-Butadiene	54.09	106-99-0	0.020	0.044
Carbon Tetrachloride	153.82	56-23-5	0.020	0.126
Chlorobenzene	112.56	108-90-7	0.020	0.092
Chloroethane (Ethyl Chloride)	64.51	75-00-3	0.020	0.053
Chloroform	119.38	67-66-3	0.020	0.098
Chloromethane	50.49	74-87-3	0.020	0.041
Cyclohexane	84.16	110-82-7	0.020	0.069
Dibromochloromethane	208.28	124-48-1	0.020	0.170
1,2-Dibromoethane (EDB)	187.86	106-93-4	0.020	0.154
1,2-Dichlorobenzene	147.00	95-50-1	0.020	0.120
1,3-Dichlorobenzene	147.00	541-73-1	0.020	0.120
1,4-Dichlorobenzene	147.00	106-46-7	0.020	0.120
Dichlorodifluoromethane (Freon 12)	120.91	75-71-8	0.020	0.099
1,1-Dichloroethane	98.96	75-34-3	0.020	0.081
1,2-Dichloroethane	98.96	107-06-2	0.020	0.081
1,1-Dichloroethene	96.94	75-35-4	0.020	0.079
cis-1,2-Dichloroethene	96.94	156-59-2	0.020	0.079
trans-1,2-Dichloroethene	96.94	156-60-5	0.020	0.079
Dichloromethane (Methylene chloride)	84.93	75-09-2	0.020	0.069
1,2-Dichloropropane	112.99	78-87-5	0.020	0.092
cis-1,3-Dichloropropene	110.97	10061-01-5	0.020	0.091
trans-1,3-Dichloropropene	110.97	10061-02-6	0.020	0.091
1,4-Dioxane	88.11	123-91-1	0.020	0.072
Ethyl Acetate	88.11	141-78-6	0.020	0.072
Ethylbenzene	106.17	100-41-4	0.020	0.087
4-Ethyltoluene	120.19	622-96-8	0.020	0.098

Typical Reporting Limits for Volatile Organic Compounds (cont'd)

Analyte	MW	CAS Number	Reporting Limits	
			ppbv	µg/m³
Freon 113 (Trichlorotrifluoroethane)	187.37	76-13-1	0.020	0.153
Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	170.92	76-14-2	0.020	0.140
n-Heptane	100.20	142-82-5	0.020	0.082
2-Hexanone (MBK)	100.16	591-78-6	0.020	0.082
n-Hexane	86.18	110-54-3	0.020	0.070
Isopropyl Alcohol (2-Propanol)	60.10	67-63-0	0.200	0.492
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	100.16	108-10-1	0.020	0.082
Methyl Tert-Butyl Ether	88.15	1634-04-4	0.020	0.072
m & p -Xylene	106.17	108-38-3	0.040	0.174
Naphthalene	128.17	91-20-3	0.020	0.105
o-Xylene	106.17	95-47-6	0.020	0.087
Propene (Propylene)	42.08	115-07-1	0.200	0.344
Styrene	104.15	100-42-5	0.020	0.085
1,1,2,2-Tetrachloroethane	167.85	79-34-5	0.020	0.137
Tetrachloroethene	165.83	127-18-4	0.020	0.136
Tetrahydrofuran (THF)	72.11	109-99-9	0.020	0.059
Toluene	92.14	108-88-3	0.020	0.075
1,1,1-Trichloroethane	133.40	71-55-6	0.020	0.109
1,1,2-Trichloroethane	133.40	79-00-5	0.020	0.109
Trichloroethene	131.39	79-01-6	0.020	0.107
Trichlorofluoromethane (Freon 11)	137.37	75-69-4	0.020	0.112
1,2,3-Trichloropropane	147.43	96-18-4	0.020	0.121
1,2,4-Trimethylbenzene	120.19	95-63-6	0.020	0.098
1,3,5-Trimethylbenzene	120.19	108-67-8	0.020	0.098
Vinyl Acetate	86.09	108-05-4	0.020	0.070
Vinyl Chloride	62.50	75-01-4	0.020	0.051

APPENDIX B
Air Sampling Worksheet - SUMMA Canister
SOP #1704
November 2015

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EPA/Environmental Response Team
Scientific, Engineering, Response and Analytical Services
Lockheed Martin Corp., Edison, NJ
U.S. EPA Contract No. EP-W-09-031

Air Sampling Work Sheet - SUMMA

Site: ______________________________ WA# _______

Sampler: ___________________________ U.S. EPA/ERT WAM:_______________

Date: ______________________________ SERAS Task Leader:_________________

Sample #					
Location					
Sub-Location					
Summa #					
Orifice ID					
Start Pressure					
NIST Gauge S/N					
Flow Rate (Start)					
Flow meter					
Analysis/Method					
Time/Counter (Start)					
Time/Counter (Stop)					
Total Time					
End Pressure					
NIST Gauge S/N					

MET Station on Site?: Y / N