SUMMA CANISTER SAMPLING

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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 passivated stainless steel canisters. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass-selective detector or multidetector techniques. This method presents procedures for sampling into canisters at final pressures below atmospheric pressure (referred to as sub atmospheric pressure sampling). The Fallon Cross-sectional Exposure Assessment (CEA) study will include sampling for VOCs from "control and case" sets of homes to develop a statistical database. The canisters are sent to a certified testing lab in a timely fashion to insure quality of sample. The results will be returned to NDEP for consolidation and distribution to appropriate agencies or homeowners.

This method is applicable to specific VOCs that have been tested and determined to be stable when stored in sub atmospheric pressure canisters. The organic compounds that have been successfully collected in pressurized canisters by this method are listed in the Volatile Organic Compound Data Sheet (Appendix A). These compounds have been measured at the parts per billion by volume (PPBV) level.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other site limitations. In all instances, the sampling team should document the procedures employed.

Mention of trade names or commercial products does not constitute NDEP endorsement or recommendation of use.

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2.0 METHOD SUMMARY

Sub atmospheric pressure sampling uses an initially evacuated canister. The canister has a hand valve and fixed orifice to regulate flow. Sub atmospheric pressure sampling is performed without a micro metering valve for taking grab samples. With this configuration, a grab sample of ambient air is drawn into a pre-evacuated Summa passivated canister. The canister is placed in the approximate breathing height of the child. The hand valve is opened a quarter turn until the sound changes as it nears atmospheric pressure, and the hand valve is then closed. Normal documentation, custody and sealing of the sample are completed and the package is readied for shipping.

3.0 SAMPLE PRESERVATION, CONTAINERS HANDLING, AND STORAGE

After the air sample is collected, the canister valve is closed, cap is installed, 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 is recorded. Sample holding times and expiration are to be determined prior to initiating field activities.

Care must be taken not to exceed 40 psi in the canister (do not heat canister above 140^{o}F). Canisters should not be dented or punctured. They should be stored in a cool dry place and always be placed in their cardboard shipping boxes or similar protective carrier during transport and storage.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Contamination may occur in the sampling system if canisters are not properly cleaned before use. Additionally, all sampling equipment should be thoroughly cleaned. Instructions for cleaning the Summa canisters are described in ERT/REAC SOP # 1703, Summa Canister Cleaning Procedures. During this study pre-certified and clean canisters are being supplied. No cleaning of the exterior is required.

5.0 EQUIPMENT/MATERIALS REQUIRED

The following equipment/apparatus (Figure 1) is required:

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5.1 Sub atmospheric Pressure Sampling Equipment

5.1.1 VOC canister sampler – whole air sampler capable of filling an initially evacuated canister by action of the hand valve from vacuum to near atmospheric pressure.

6.0 PROCEDURE

6.1 Sub atmospheric Pressure Sampling

6.1.1 Sampling using a Hand Valve and SUMMA (vacuum) Canister.

6.1.2 Prior to sampling collection, the appropriate information is completed on the Canister Sampling Field Data Sheet (Appendix B) and brass cap is removed with $^{9}/_{16}$ inch end wrench.

6.1.3 Place canister at the "breathing height" of the child (approximately the height of an average adult knee) in a room where the child spends the most of the time.

6.1.4 A canister, which is evacuated to at least 26 inches Hg hand valve, is opened to the atmosphere containing the air to be sampled.

6.1.5 The pressure differential causes the sample to flow into the canister.

6.1.6 This technique is used to collect grab samples (duration of 15 to 30 seconds). The sampling duration depends on the degree to which the flow is restricted.

6.1.7 A fixed orifice flow restrictor will have a decrease in the flow rate as the vacuum canister approaches atmospheric (which is indicated by a change in pitch or sound level). Shut off hand valve immediately to avoid canister becoming neutral with atmosphere (It should remain in a slight vacuum). If the canister is allowed to become neutral the test is void. Repeat test with new canister

6.1.8 Upon sample completion at the location, the appropriate information is recorded on the Canister Sampling Field Data Sheet and labels (Note the final vacuum reading on canister: approximately 2 to 10 inches of mercury (Hg) by gauge on tank or separate gauge as available on each canister. Separate gauge will need to be attached and removed. Zero gauge before reading).

6.1.9 Cap the SUMMA Canister with the cap and tighten with wrench slightly to seal vacuum.

6.1.10 Place canister into a cardboard box labeled for shipping with the Field Data Sheet information and labels in the plastic luggage tag type of holder.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody records, field data sheets, or site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.
3. Duplicate samples will be taken as 1 in 10 samples.
4. Blank samples or "zero air," (sample not taken) will be returned as 1 in 20 samples.

8.0 HEALTH AND SAFETY

Health and Safety procedures as described and defined in the NDEP Health and Safety Plan (HASP) must be observed and implemented prior to dust sample collection. Chemical exposures are not anticipated, and physical or mechanical hazards are only those that would be found in any typical household environment.

9.0 REFERENCES

1. U.S EPA, "Environmental Response Team Standard Operating Procedures #1704", July 27, 1995.

2. AIR TOXICS LTD, "Method: TO-14 list of proposed sample tests," September 30, 2001.

3. Health and Safety Plan, *Prepared in Support of: CDC/NCEH Cross-sectional* Exposure Assessment Study – Churchill County, Nevada. September 25, 2001.

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Appendix A – Chemicals to be Analyzed

Chemical Abstract Service (CAS #)	CHEMICAL COMPOUND	FORMULA	Molecular Weight	Boiling Point (°C)	Melting Point (°C)
Freon 12	Dichlorodifluoromethane	Cl_2CF_2	120.91	-29.8	-158.00
74-87-3	Methyl chloride (Chloromethane)	340	50.49	-24.2	-97.10
Freon 114	1,2-Dichloro-1,1,2-tetrafluoroethane	$ClCF_2CClF_2$	170.93	4.1	-94.00
75-01-4	Vinyl Chloride, Chloroethylene	CH_3=CHCl	62.5	-13.4	-1,538.00
74-83-9	Methyl bromide, Bromomethane, monobromomethane, embafume	CH_3Br	94.94	3.6	-93.60
75-00-3	Ethyl chloride, Chloroethane, monochlorethane, chlorethyl, aethylis chloridum, ether chloratus, ether hydrochloric, ether muriatic, Kelene, Chelen, Anodynon, Chloryl Anesthetic, Narcotile	CH_3CH_2Cl	64.52	12.3	-136.40
Freon 11	Trichlorodifluoromethane	CCl_3F	137.38	23.7	-111.00
75-35-4	Vinylidene chloride, 1,1-Dichloroethylene, 1,1-Dichloroethene, asym-dichloroethylene	$C_2H_2Cl_2$	96.95	31.7	-122.50
75-09-2	Methylene chloride, Dichloromethane, Methylene dichloride	CH_2Cl_2	84.94	39.8	-95.10
Freon 113	1,1,2-Trichloro-1,2,2-trifluroethane	CF_2ClCCl_2F	187.38	47.7	-36.40
74-34-3	1,1,2-Dichloroethane, Ethylidene Chloride	CH_3CHCl_2	98.96	57.3	-97.00
	cis-1,2-Dichloroethylene	CHCl=CHCl	96.94	60.3	-80.50
67-66-3	Chloroform, trichloromethane	$CHCl_3$	119.38	61.7	-63.50
107-06-2	Ethylene dichloride, 1,2-Dichloroethane, sym-dichloroethane, ethylene chloride, dutch liquid, brocide	$ClCh_2CH_2Cl$	98.96	83.5	-35.30
71-55-6	Methyl chloroform, 1,1,1-Trichloroethane, Methylchloroform, chlorothene	CH_3CCl_3	133.41	74.1	-30.40
71-43-2	Benzene (including benzene from gasoline), benzol, cyclohexatriene	C_6H_6	78.12	80.1	5.50
56-23-5	Carbon Tetrachloride, tetrachloromethane, perchloromethane, necatorina, benzinoform	CCl_4	153.82	76.5	-23.00
78-87-5	Propylene dichloride (1,2-Dichloropropane)	$CH_3CHClCH_2Cl$	112.99	96.4	-100.40
79-01-6	TCE, Trichloroethylene, trichloroethene, ethinyl trichloride,Ttri-clene,Ttrielene, Trilene, Trichloran,Ttrichloren, Algylen, Trimar, Triline, Tri, Trethylene, Westrosol, Chlorylen, Gemalgene, Germalgene	$ClCH=CCl_2$	131.29	87	-73.00

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Appendix A – Chemicals to be Analyzed

Chemical Abstract Service (CAS #)	CHEMICAL COMPOUND	FORMULA	Molecular Weight	Boiling Point (°C)	Melting Point (°C)
	cis-1,3-Dichloropropene (cis-1,3-dichloropropylene)	CH3CCl=CHCl	110.97	76	
	trans-1,3-Dichloropropene (cis-1,3-dichloropropylene)	CH3CCl=CHCl	110.97	112	
79-00-5	Trichloroethane; 1,1,2-Trichloroethane, vinyl trichloride, beta-trichloroethane	$CH_2ClCHCl_2$	133.41	113.8	-36.50
108-88-3	Toluene, methylbenzene, toluol, phenylmethane, methacide	$C_6H_5CH_3$	92.15	110.6	-95.00
106-93-4	Ethylene Dibromide, Dibromoethane	$BrCH_2CH_2Br$	187.88	131.3	9.80
127-18-4	Perc, Perk, Tetrachloroethylene, Perchloroethylene, ethylene tetrachloride, tetrachlorethene, nema, tetracap, tetropil, perclene, ankilostin, didakene	$Cl_2C=CCl_2$	165.83	121.1	-19.00
108-90-7	Chlorobenzene, monochlorobenzene, benzene chloride	C_6H_5Cl	112.56	132	-45.60
100-41-4	Ethylbenzene, Ethyl benzene	$C_6H_5C_2H_5$	106.17	136.2	-95.00
	m-xylene (1,3-Dimethy Tbenzene)	$1,3\text{-}(CH_3)_2C_6H_4$	106.17	139.1	-47.90
	p-xylene (1,4-Dimethy Tbenzene)	$C_6H_5C_2H_5$	106.17	138.3	13.30
100-42-5	Styrene, Ethenylbenzene, styrol, styrolene, cinnamene, cinnamol, phenylethylene, vinylbenzene	$C_6H_5CH=CH_2$	104.16	145.2	-30.60
79-34-5	Tetrachloroethane, 1,1,2,2-Tetrachloroethane, sym-tetrachloroethane, acetylene tetrachloride, cellon, bonoform	$CHCl_2CHCl_2$	167.85	146.2	-36.00
	o-Xylene (1,2-Dimethy lbenzene)	$1,2\text{-}(CH_3)_2C_6H_4$	106.17	144.4	-25.20
108-67-8	1,3,5-Trimethylbenzene (Mesitylene)	$1,3,5\text{-}(CH_3)_3C_6H_6$	120.2	164.7	-44.70
95-63-6	1,3,4-Trimethylbenzene (Pseudocumene)	$1,3,4\text{-}(CH_3)_3C_6H_6$	120.2	169.3	-43.80
541-73-1	m-Dichlorobenzene (1,3-Dichlorobenzene)	$1,3,\text{-}Cl_2C_6H_4$	147.01	173	-24.70
100-44-7	Benzyl chloride	$C_6H_5CH_2Cl$	126.59	179.3	-39.00
95-50-1	Dichlorobenzene; o-Dichlorobenzene, 1,2-dichlorobenzene	$1,2\text{-}Cl_2C_6H_4$	147.01	180.5	-17.00
106-46-7	Dichlorobenzene; 1,4 Dichlorobenzene, p-Dichlorobenzene, 1,4-Dichlorobenzene(p)	$1,4\text{-}Cl_2C_6H_4$	147.01	174	53.10
120-82-1	Trichlorobenzene; 1,2,4-Trichlorobenzene	$1,2,4\text{-}Cl_3C_6H_3$	181.45	213.5	17.00

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Appendix A – Chemicals to be Analyzed

Chemical Abstract Service (CAS #)	CHEMICAL COMPOUND	FORMULA	Molecular Weight	Boiling Point (°C)	Melting Point (°C)
	Hexachlorobutadiene (1,1,2,3,4,4-Hexachloro-1,3-butadiene)				
	1,2-Dichloroethane				
	cis-1,3-Dichloroethane				
	Chlorotoluene				
	1,2-Dichlorobenzene				
	2,5-Dimethylfuran				
	1,3-Butadiene				
	Acetone				
	Carbon Disulfide				
	2-Propanol				
	trans-1,2-Dichloroethene				
	Vinyl Acetate				
	2-Butanone (Methyl Ethyl Ketone)				
	Hexane				
	Tetrahydrofuran				
	Cyclohexane				
	1,4-Dioxane				
	Bromodichloromethane				
	4-Methyl-2-pentanone				
	2-Hexanone				
	Dibromochloromethane				
	Bromoform				
	4-Ethyltoluene				
	Ethanol				
	Methyl tert-Butyl Ether				
	Heptane				
Surrogate					
	1,2-Dichloroethane-d4				
	Toluene-d8				
	4-Bromoflurobenzene				

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Field Data Sheet -Appendix B

Site: Date:	Samplers:
Sample #	
Location:	
Summa ID:	
Method: Grab	
Time (Seconds):	
Summa went to ambient pressure? (y/n)	
Pressure gauge reading (Pre opening)	
Pressure gauge reading (Post opening)	
Sketch/ General Comments:	

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Figure 1. Sub-atmospheric/Sampling Equipment

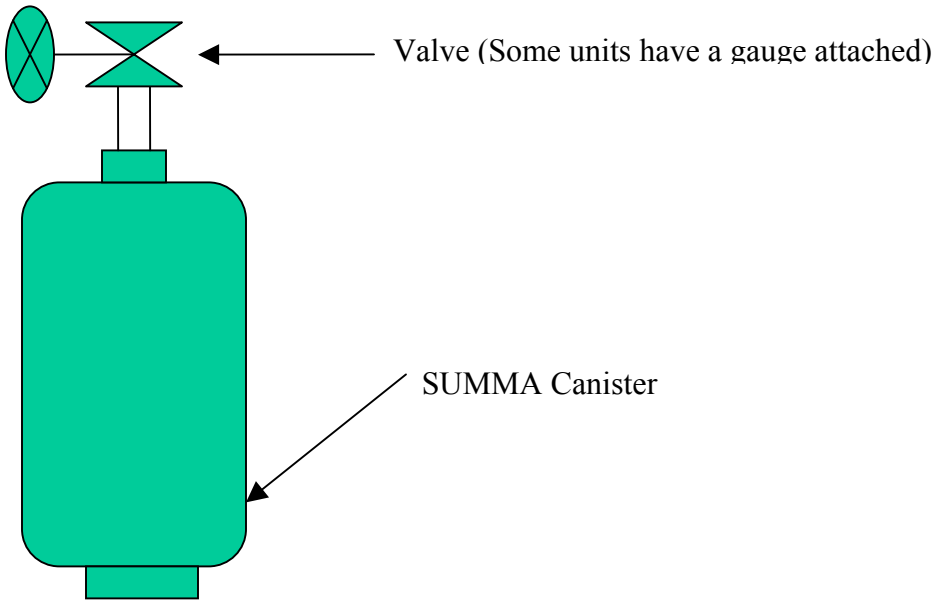

Figure 1