



APPENDIX 4-A RECOMMENDATIONS FOR MIS FIELD PRESERVATION OR LABORATORY SUBSAMPLING BASED ON OVERALL CHEMICAL STABILITY

**TABLE 4-A1
Volatile Chemicals Requiring Field Preservation of Soil Sample
Increments**

CHEMICAL PARAMETER	Physical State		Molecular Weight	² Vapor Pressure	Henry's Law Constant (H)
	V	L		mm Hg (25C)	(atm-m ³ /mol)
VOLATILE CHEMICALS					
Preserve Samples in Methanol in the Field (or approved alternative, see text) (VP>1 AND Molecular Weight <200)					
ACETONE	V	L	58	2.3E+02	3.9E-05
BENZENE	V	L	78	9.5E+01	5.61E-03
BIS(2-CHLOROETHYL)ETHER	V	L	143	1.6E+00	1.7E-05
BROMODICHLOROMETHANE	V	L	164	5.0E+01	2.1E-03
BROMOFORM	V	S	253	5.4E+00	5.4E-04
BROMOMETHANE	V	G	95	1.6E+03	6.3E-03
CARBON TETRACHLORIDE	V	L	154	1.2E+02	2.7E-02
CHLOROETHANE	V	G	65	1.0E+03	1.1E-02
CHLOROFORM	V	L	119	2.0E+02	3.7E-03
CHLOROMETHANE	V	G	50	4.3E+03	8.8E-03
CHLOROPHENOL, 2-	V	L	129	2.5E+00	1.1E-05
DIBROMOCHLOROMETHANE	V	S	208	5.5E+00	7.8E-04
DIBROMOETHANE, 1,2-	V	S	188	1.1E+01	6.6E-04
DICHLOROETHANE, 1,2-	V	L	147	1.4E+00	1.9E-03
DICHLOROETHANE, 1,3-	V	L	147	2.2E+00	1.9E-03
DICHLOROETHANE, 1,4-	V	S	147	1.7E+00	2.4E-03
DICHLOROETHANE, 1,1-	V	L	99	2.3E+02	5.6E-03
DICHLOROETHANE, 1,2-	V	L	99	7.9E+01	1.2E-03
DICHLOROETHYLENE, 1,1-	V	L	97	6.0E+02	2.7E-02
DICHLOROETHYLENE, Cis 1,2-	V	L	97	2.0E+02	4.1E-03
DICHLOROETHYLENE, Trans 1,2-	V	L	97	3.3E+02	9.3E-03
DICHLOROPROPANE, 1,2-	V	L	113	5.3E+01	2.9E-03

DICHLOROPROPENE, 1,3-	V	L	111	3.4E+01	3.7E-03
DIOXANE, 1,4-	V	L	88	3.8E+01	4.9E-06
ETHANOL	V	L	46	5.9E+01	6.3E-06
ETHYLBENZENE	V	L	106	9.6E+00	7.8E-03
METHYL ETHYL KETONE	V	L	72	9.1E+01	5.6E-05
METHYL ISOBUTYL KETONE	V	L	100	2.0E+01	1.4E-04
METHYL TERT BUTYL ETHER	V	L	88	2.5E+02	5.9E-04
METHYLENE CHLORIDE	V	L	85	4.4E+02	3.2E-03
STYRENE	V	L	104	6.4E+00	2.7E-03
tert-BUTYL ALCOHOL	V	L	74	4.1E+01	1.2E-05
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	4.6E+00	2.4E-03
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	4.6E+00	3.7E-04
TETRACHLOROETHYLENE	V	L	166	1.9E+01	1.8E-02
TOLUENE	V	L	92	2.8E+01	6.6E-03
TPH (gasolines)	V	L	108	6.8E+02	7.2E-04
TRICHLOROETHANE, 1,1,1-	V	L	133	1.2E+02	1.7E-02
TRICHLOROETHANE, 1,1,2-	V	L	133	2.3E+01	8.3E-04
TRICHLOROETHYLENE	V	L	131	6.9E+01	9.8E-03
TRICHLOROPROPANE, 1,2,3-	V	L	147	3.7E+00	3.4E-04
TRICHLOROPROPENE, 1,2,3-	V	L	145	3.7E+00	2.8E-02
VINYL CHLORIDE	V	G	63	3.0E+03	2.7E-02
XYLENES	V	L	106	8.0E+00	7.1E-03

Reference: Appendix 1, Table H in HEER Office Environmental Hazard Evaluation guidance ([HDOH 2016](#)).

1. Physical state of chemical at ambient conditions (V - volatile, SV - Semi-Volatile (*SV - Treated as "volatile" in USEPA risk assessment models if $H \geq 0.00001$), S - solid, L - liquid, G - gas).
2. Vapor Pressures from National Library of Medicine TOXNET or ChemID databases.
3. Check with lab to determine feasibility of wet sieving sample to remove >2mm particles prior to subsampling.
4. Soil or sediment samples that consist entirely of <2mm material *do not* require drying and sieving to address fundamental error concerns, although some degree of drying and sieving may be desirable by the laboratory for testing purposes.



APPENDIX 4-A

RECOMMENDATIONS FOR MIS FIELD PRESERVATION OR LABORATORY SUBSAMPLING BASED ON OVERALL CHEMICAL STABILITY

TABLE 4-A2a
**Semi-volatile or Otherwise Unstable Chemicals Requiring
Laboratory Subsampling of Soil Samples Prior to Processing**

CHEMICAL PARAMETER			² Vapor Pressure	Henry's Law Constant	
	¹ Physical State	Molecular Weight	mm Hg (25C)	(H) (atm·m ³ /mol)	
SEMI-VOLATILE AND OTHER SEMI-STABLE CHEMICALS					
^{3,4} Subsample Multi Increment Bulk Sample at Laboratory Upon Receipt Without Drying (VP 0.1 to 1.0 <u>OR</u> Liquid at 25C <u>OR</u> Henry's Constant >1.0E-05)					
BIPHENYL, 1,1-	*SV	S	154	8.9E-03	3.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	*SV	L	171	8.5E-01	1.1E-04
DALAPON	*SV	L	143	1.9E-01	9.0E-08
DIBROMO,1,2- CHLOROPROPANE,3-	*SV	L	236	5.8E-01	1.5E-04
DIMETHYLPHENOL, 2,4-	SV	S	122	1.0E-01	9.5E-07
HEXACHLOROBUTADIENE	SV	S	261	2.2E-01	1.0E-02
HEXACHLOROETHANE	SV	S	237	4.0E-01	3.9E-03
ISOPHORONE	SV	L	138	4.4E-01	6.6E-06
⁵ MERCURY	*SV	S	201	2.0E-03	-
METHYL MERCURY	SV	S	216	-	-
NITROBENZENE	*SV	L	123	2.5E-01	2.4E-05
NITROGLYCERIN	SV	L	227	2.0E-04	9.8E-08
NITROTOLUENE, 4-	SV	S	137	1.6E-01	5.6E-06
NITROTOLUENE, 2-	*SV	S	137	1.9E-01	1.2E-05
NITROTOLUENE, 3-	*SV	S	137	2.1E-01	2.4E-05
⁶ PAHs (varies, see Table 4-2b)	*SV	S			
PHENOL	SV	S	94	3.5E-01	3.4E-07
PROPICONAZOLE	SV	L	342	1.0E-06	4.1E-09
⁷ TPH (middle distillates)	*SV	L	170	2 to 26	7.2E-04
TRICHLOROBENZENE, 1,2,4-	*SV	S	181	4.6E-01	1.4E-03

Reference: Appendix 1, Table H in HEER Office Environmental Hazard Evaluation guidance ([HDOH, 2016](#)).

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1. Physical state of chemical at ambient conditions (V - volatile, SV - Semi-Volatile (*SV - Treated as "volatile" in USEPA risk assessment models if $H \geq 0.00001$), S - solid, L - liquid, G - gas).
 2. Vapor Pressures from National Library of Medicine TOXNET or ChemID databases.
 3. Check with lab to determine feasibility of wet sieving sample to remove >2mm particles prior to subsampling.
 4. Soil or sediment samples that consist entirely of <2mm material *do not* require drying and sieving to address fundamental error concerns, although some degree of drying and sieving may be desirable by the laboratory for testing purposes.
 5. The stability of a targeted metal depends in part on the species present and can be highly variable. Identification of specific species of a metal may require the collection of aliquots prior to drying and sieving and should be evaluated on a site-by-site basis with respect to the site investigation objectives
 6. PAHS - See Table 4-B2b. Eighteen targeted PAHs listed in [Section 9](#) of the HEER Office TGM.
 7. TPH diesel may not be adequately extractable from soil or sediment when placed in methanol; aliquots should be collected and extracted at the laboratory (e.g., using methylene chloride).



APPENDIX 4-A RECOMMENDATIONS FOR MIS FIELD PRESERVATION OR LABORATORY SUBSAMPLING BASED ON OVERALL CHEMICAL STABILITY

TABLE 4-A2b Physiochemical Constants for Targeted PAHs

³ Targeted PAHs	¹ PhysicalState		Molecular Weight	² VaporPressure	Henry's Law Constant (H)
				mm Hg (25C)	(atm-m ³ /mol)
Semi-Volatile PAHs (VP 0.1 to 1.0 OR Liquid at 25C OR Henry's Constant $\geq 1.0E-05$) ^{3,4} Subsample Multi Increment Bulk Sample at Laboratory Upon Receipt Without Drying					
ACENAPHTHENE	*SV	S	154	2.2E-03	1.8E-04
ACENAPHTHYLENE	*SV	S	152	6.7E-03	1.5E-03
ANTHRACENE	*SV	S	178	6.6E-06	5.6E-05
FLUORENE	*SV	S	166	3.2E-04	9.5E-05
METHYLNAPHTHALENE, 1-	*SV	S	142	6.7E-02	5.1E-04
METHYLNAPHTHALENE, 2-	*SV	S	142	5.5E-02	5.1E-04
NAPHTHALENE	*SV	S	128	8.5E-02	4.4E-04
PHENANTHRENE	*SV	S	178	1.2E-04	3.9E-05
PYRENE	*SV	S	202	4.5E-06	1.2E-05
Non-Volatile PAHs (VP <0.1 AND Solid at 25C AND Henry's Constant <1.0E-05) ⁴ Dry and Sieve Multi Increment Samples for Preparation of Aliquots					
BENZO(a)ANTHRACENE	NV	S	228	5.0E-09	1.2E-05
BENZO(a)PYRENE	NV	S	252	5.5E-09	4.6E-07
BENZO(b)FLUORANTHENE	NV	S	252	5.0E-07	6.6E-07
BENZO(g,h,i)PERYLENE	NV	S	276	-	1.4E-07
BENZO(k)FLUORANTHENE	NV	S	252	9.7E-10	5.9E-07
CHRYSENE	NV	S	228	6.2E-09	5.1E-06
DIBENZO(a,h)ANTHTRACENE	NV	S	278	9.6E-10	1.2E-07
FLUORANTHENE	NV	S	202	9.2E-06	8.8E-06
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.2E-10	3.4E-07

Reference: Appendix 1, Table H in HEER Office Environmental Hazard Evaluation guidance ([HDOH, 2016](#)).

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1. Physical state of chemical at ambient conditions (V - volatile, SV - Semi-Volatile (*SV - Treated as "volatile" in USEPA risk assessment models if $H \geq 0.00001$), S - solid, L - liquid, G - gas).
 2. Vapor Pressures from National Library of Medicine TOXNET or ChemID databases.
 3. PAHS - Eighteen targeted PAHs listed in [Section 9](#) of the HEER Office TGM. Recommendation to subsample the Multi Increment sample without drying applies primarily to acenaphthene, acenaphthylene, anthracene, fluorene, methylnaphthalenes, naphthalene and phenanthrene and pyrene.
 4. Soil or sediment samples that consist entirely of <2mm material *do not* require drying and sieving to address fundamental error concerns, although some degree of drying and sieving may be desirable by the laboratory for testing purposes.