



Multi-Media, Multi-Concentration, Organic Analytical Service for Superfund (SOM01.2)

Office of Superfund Remediation and Technology Innovation (OSRTI)
Analytical Services Branch (ASB) (5203P)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to the EPA at such sites are a series of volatile, semivolatile, pesticide, and Aroclor compounds that are analyzed using gas chromatography coupled with mass spectrometry (GC/MS) and gas chromatography with an electron capture detector (GC/ECD). The Analytical Services Branch (ASB) of the Office of Superfund Remediation and Technology Innovation (OSRTI) offers an analytical service that provides data from the analysis of water and soil/sediment samples for organic compounds for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the organic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

DESCRIPTION OF SERVICES

This new organic analytical service provides a technical and contractual framework for laboratories to apply EPA/CLP analytical methods for the isolation, detection, and quantitative measurement of 52 volatile, 67 semivolatile, 21 pesticide, and 9 Aroclor target compounds in water and soil/sediment environmental samples. The CLP provides the methods to be used and the specific technical, reporting, and contractual requirements, including Quality Assurance (QA), Quality Control (QC), and Standard Operating Procedures (SOPs), by which EPA evaluates the data. This service uses GC/MS and GC/ECD methods to analyze the target compounds.

Three data delivery turnarounds are available to CLP customers: 7-day, 14-day, and 21-day turnaround after laboratory receipt of the last sample in the set. In addition, there are 48-hour (for trace volatiles and volatiles) and 72-hour (for semivolatiles, pesticides, and Aroclors) preliminary data submission options available. Options under this service include a closed system purge-and-trap method for low-level volatile soil analysis and methanol preservation for medium-level volatile soil analysis. In addition, data users may request modifications to the SOW that may include, but are not limited to, additional compounds, sample matrices other than soil/sediment or water, lower quantitation limits, and other requirements to enhance method performance.

DATA USES

This analytical service provides data which EPA uses for a variety of purposes, such as determining the nature and extent of contamination at a hazardous waste site, assessing priorities for response based on risks to human health and the environment, determining appropriate cleanup actions, and determining when remedial actions are complete. The data may be used in all stages in the investigation of a hazardous waste site including, but not limited to: site inspections; Hazard Ranking System (HRS) scoring; remedial investigations/Feasibility Studies (FSs); remedial design; treatability studies; and removal actions. In addition, this service provides data that will be available for use in Superfund enforcement/litigation activities.

TARGET COMPOUNDS

Table 1 lists the compounds for which this service is applicable and the corresponding quantitation limits. Specific quantitation limits are highly matrix-dependent.

Table 1. Target Compound List (TCL) and Contract Required Quantitation Limits (CRQLs) for SOM01.2*

Quantitation Limits						Quantitation Limits					
	Trace Water by SIM (µg/L)	Trace Water (µg/L)	Low Water (µg/L)	Low Soil (µg/kg)	Med. Soil (µg/kg)		Trace Water by SIM (µg/L)	Trace Water (µg/L)	Low Water (µg/L)	Low Soil (µg/kg)	Med. Soil (µg/kg)
<u>VOLATILES</u>						<u>VOLATILES (CON'T)</u>					
1. Dichlorodifluoromethane		0.50	5.0	5.0	250	40. Ethylbenzene	0.50		5.0	5.0	250
2. Chloromethane		0.50	5.0	5.0	250	41. o-Xylene	0.50		5.0	5.0	250
3. Vinyl Chloride		0.50	5.0	5.0	250	42. m, p-Xylene	0.50		5.0	5.0	250
4. Bromomethane		0.50	5.0	5.0	250	43. Styrene	0.50		5.0	5.0	250
5. Chloroethane		0.50	5.0	5.0	250	44. Bromoform	0.50		5.0	5.0	250
6. Trichlorofluoromethane		0.50	5.0	5.0	250	45. Isopropylbenzene	0.50		5.0	5.0	250
7. 1,1-Dichloroethene		0.50	5.0	5.0	250	46. 1,1,2,2-Tetrachloroethane	0.50		5.0	5.0	250
8. 1,1,2-Trichloro-1,2,2-trifluoroethane		0.50	5.0	5.0	250	47. 1,3-Dichlorobenzene	0.50		5.0	5.0	250
9. Acetone		5.0	10	10	500	48. 1,4-Dichlorobenzene	0.50		5.0	5.0	250
10. Carbon Disulfide		0.50	5.0	5.0	250	49. 1,2-Dichlorobenzene	0.50		5.0	5.0	250
11. Methyl acetate		0.50	5.0	5.0	250	50. 1,2-Dibromo-3-chloropropane	0.050	0.50	5.0	5.0	250
12. Methylene chloride		0.50	5.0	5.0	250	51. 1,2,4-Trichlorobenzene	0.50		5.0	5.0	250
13. trans-1,2-Dichloroethene		0.50	5.0	5.0	250	52. 1,2,3-Trichlorobenzene	0.50		5.0	5.0	250
14. Methyl tert-butyl ether		0.50	5.0	5.0	250						
							Low Water by SIM (µg/L)	Low Water (µg/L)	Low Soil by SIM (µg/kg)	Low Soil (µg/kg)	Med. Soil (µg/kg)
						<u>SEMIVOLATILES</u>					
15. 1,1-Dichloroethane		0.50	5.0	5.0	250	53. Benzaldehyde		5.0		170	5000
16. cis-1,2-Dichloroethene		0.50	5.0	5.0	250	54. Phenol		5.0		170	5000
17. 2-Butanone		5.0	10	10	500	55. bis-(2-chloroethyl) ether		5.0		170	5000
18. Bromochloromethane		0.50	5.0	5.0	250	56. 2-Chlorophenol		5.0		170	5000
19. Chloroform		0.50	5.0	5.0	250	57. 2-Methylphenol		5.0		170	5000
20. 1,1,1-Trichloroethane		0.50	5.0	5.0	250	58. 2,2'-Oxybis (1-chloropropane)		5.0		170	5000
21. Cyclohexane		0.50	5.0	5.0	250	59. Acetophenone		5.0		170	5000
22. Carbon tetrachloride		0.50	5.0	5.0	250	60. 4-Methylphenol		5.0		170	5000
23. Benzene		0.50	5.0	5.0	250	61. N-Nitroso-di-n propylamine		5.0		170	5000
24. 1,2-Dichloroethane		0.50	5.0	5.0	250	62. Hexachloroethane		5.0		170	5000
25. 1,4-Dioxane			100	100	5000	63. Nitrobenzene		5.0		170	5000
26. Trichloroethene		0.50	5.0	5.0	250	64. Isophorone		5.0		170	5000
27. Methylcyclohexane		0.50	5.0	5.0	250	65. 2-Nitrophenol		5.0		170	5000
28. 1,2-Dichloropropane		0.50	5.0	5.0	250	66. 2,4-Dimethylphenol		5.0		170	5000
29. Bromodichloromethane		0.50	5.0	5.0	250	67. Bis (2-chloroethoxy) methane		5.0		170	5000
30. cis-1,3-Dichloropropene		0.50	5.0	5.0	250	68. 2,4-Dichlorophenol		5.0		170	5000
31. 4-Methyl-2-pentanone		5.0	10	10	500	69. Napthalene	0.10	5.0	3.3	170	5000
32. Toluene		0.50	5.0	5.0	250	70. 4-Chloroaniline		5.0		170	5000
33. trans-1,3-Dichloropropene		0.50	5.0	5.0	250	71. Hexachlorobutadiene		5.0		170	5000
34. 1,1,2-Trichloroethane		0.50	5.0	5.0	250	72. Caprolactam		5.0		170	5000
35. Tetrachloroethene		0.50	5.0	5.0	250	73. 4-Chloro-3-methylphenol		5.0		170	5000
36. 2-Hexanone		5.0	10	10	500	74. 2-Methylnapthalene	0.10	5.0	3.3	170	5000
37. Dibromochloromethane		0.50	5.0	5.0	250	75. Hexachlorocyclo-pentadiene		5.0		170	5000
38. 1,2-Dibromoethane	0.050	0.50	5.0	5.0	250	76. 2,4,6-Trichlorophenol		5.0		170	5000
39. Chlorobenzene		0.50	5.0	5.0	250	77. 2,4,5-Trichlorophenol		5.0		170	5000

* For volatiles, quantitation limits for medium soils are approximately 50 times the quantitation limits for low soils. For semivolatile medium soils, quantitation limits are approximately 30 times the quantitation limits for low soils.

Table 1. Target Compound List (TCL) and Contract Required Quantitation Limits (CRQLs) for SOM01.2* (Con't)

Quantitation Limits						Quantitation Limits					
Low Water by SIM (µg/L)	Low Water (µg/L)	Low Soil by SIM (µg/kg)	Low Soil (µg/kg)	Med. Soil (µg/kg)		Low Water by SIM (µg/L)	Low Water (µg/L)	Low Soil by SIM (µg/kg)	Low Soil (µg/kg)	Med. Soil (µg/kg)	
SEMIVOLATILES (CON'T)						SEMIVOLATILES (CON'T)					
78. 1,1'-Biphenyl	5.0		170	5000		115. Benzo (a) pyrene	0.10	5.0	3.3	170	5000
79. 2-Chloronaphthalene		5.0		170	5000	116. Indeno (1,2,3-cd)-pyrene	0.10	5.0	3.3	170	5000
80. 2-Nitroaniline		10		330	10000	117. Dibenzo (a,h)-anthracene	0.10	5.0	3.3	170	5000
81. Dimethylphthalate		5.0		170	5000	118. Benzo (g,h,i) perylene	0.10	5.0	3.3	170	5000
82. 2,6-Dinitrotoluene		5.0		170	5000	119. 2,3,4,6-Tetrachlorophenol		5.0		170	5000
83. Acenaphthylene	0.10	5.0	3.3	170	5000	PESTICIDES		Water (µg/L)	Soil (µg/kg)		
84. 3-Nitroaniline		10		330	10000	120. alpha-BHC		0.050		1.7	
85. Acenaphthene	0.10	5.0	3.3	170	5000	121. beta-BHC		0.050		1.7	
86. 2,4-Dinitrophenol		10		330	10000	122. delta-BHC		0.050		1.7	
87. 4-Nitrophenol		10		330	10000	123. gamma-BHC (Lindane)		0.050		1.7	
88. Dibenzofuran		5.0		170	5000	124. Heptachlor		0.050		1.7	
89. 2,4-Dinitrotoluene		5.0		170	5000	125. Aldrin		0.050		1.7	
90. Diethylphthalate		5.0		170	5000	126. Heptachlor epoxide		0.050		1.7	
91. Fluorene	0.10	5.0	3.3	170	5000	127. Endosulfan I		0.050		1.7	
92. 4-Chlorophenyl-phenyl ether		5.0		170	5000	128. Dieldrin		0.10		3.3	
93. 4-Nitroaniline		10		330	10000	129. 4,4'-DDE		0.10		3.3	
94. 4,6-Dinitro-2-methylphenol		10		330	10000	130. Endrin		0.10		3.3	
95. N-Nitrosodiphenylamine		5.0		170	5000	131. Endosulfan II		0.10		3.3	
96. 1,2,4,5-Tetrachlorobenzene		5.0		170	5000	132. 4-4'-DDD		0.10		3.3	
97. 4-Bromophenyl-phenylether		5.0		170	5000	133. Endosulfan sulfate		0.10		3.3	
98. Hexachlorobenzene		5.0		170	5000	134. 4-4'-DDT		0.10		3.3	
99. Atrazine		5.0		170	5000	135. Methoxychlor		0.50		17	
100. Pentachlorophenol	0.20	10	6.7	330	10000	136. Endrin ketone		0.10		3.3	
101. Phenanthrene	0.10	5.0	3.3	170	5000	137. Endrin aldehyde		0.10		3.3	
102. Anthracene	0.10	5.0	3.3	170	5000	138. alpha-Chlordane		0.050		1.7	
103. Carbazole		5.0		170	5000	139. gamma-Chlordane		0.050		1.7	
104. Di-n-butylphthalate		5.0		170	5000	140. Toxaphene		5.0		170	
105. Fluoranthene	0.10	5.0	3.3	170	5000	AROCLORS		Water (µg/L)	Soil (µg/kg)		
106. Pyrene	0.10	5.0	3.3	170	5000	141. Aroclor-1016		1.0		33	
107. Butylbenzylphthalate		5.0		170	5000	142. Aroclor-1221		1.0		33	
108. 3,3'-Dichlorobenzidine		5.0		170	5000	143. Aroclor-1232		1.0		33	
109. Benzo (a) anthracene	0.10	5.0	3.3	170	5000	144. Aroclor-1242		1.0		33	
110. Chrysene	0.10	5.0	3.3	170	5000	145. Aroclor-1248		1.0		33	
111. Bis (2-ethylhexyl) phthalate		5.0		170	5000	146. Aroclor-1254		1.0		33	
112. Di-n-octylphthalate		5.0		170	5000	147. Aroclor-1260		1.0		33	
113. Benzo (b) fluoroanthene	0.10	5.0	3.3	170	5000	148. Aroclor-1262		1.0		33	
114. Benzo (k) fluoroanthene	0.10	5.0	3.3	170	5000	149. Aroclor-1268		1.0		33	

* For volatiles, quantitation limits for medium soils are approximately 50 times the quantitation limits for low soils. For semivolatile medium soils, quantitation limits are approximately 30 times the quantitation limits for low soils.

The TCL for this service was originally derived from the EPA Priority Pollutant List of 129 compounds. In the years since the inception of the CLP, compounds have been added to and removed from the TCL, based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program. The SOM analytical service combines the previous OLM and OLC services into one method. For example, drinking water and ground water type samples may be analyzed using the Trace Volatiles method in SOM.

METHODS AND INSTRUMENTATION

For trace volatile water samples, 25 mL of water sample is added to a purge-and-trap device and purged with an inert gas at room temperature. For low/medium volatile water samples, 5 mL of water sample is added to a purge-and-trap device and purged with an inert gas at room temperature. Higher purge temperatures may be used for both trace and low/medium volatile analyses if all technical acceptance criteria is met for all standards, samples, and blanks. For low-level volatile soil samples, organic compounds are generally determined by analyzing approximately 5 g of sample in a closed-system purge-and-trap device at 40EC. For a medium-level soil sample, a soil sample of 5 g is collected, preserved, and/or extracted with methanol and an aliquot of methanol extract is added to 5 mL reagent water and purged at room temperature. For water and soil samples, the volatiles purged from the sample are trapped on a solid sorbent. The purged volatiles are subsequently desorbed by rapidly heating and backflushing with helium, and then introduced into a GC/MS system.

For semivolatile, pesticide, and Aroclor water samples, a 1 L aliquot of sample is extracted with methylene chloride using a continuous liquid-liquid extractor or separatory funnel (for pesticides and Aroclors only). For low-level semivolatile, pesticide, and Aroclor soil samples, a 30 g soil/sediment sample is extracted with methylene chloride/acetone using sonication, automated Soxhlet/Dean-Stark (SDS) extraction, or pressurized fluid extraction techniques. For medium-level semivolatile soil samples, a 1g aliquot is extracted with methylene chloride using the techniques mentioned above for low-level soil samples. For both water and soil samples, the extract is concentrated, subjected to fraction-specific cleanup procedures, and analyzed by GC/MS for semivolatiles or GC/ECD for pesticides and Aroclors. **Table 2** summarizes the methods and instruments used in this analytical service.

DATA DELIVERABLES

Data deliverables for this service include hardcopy data reporting forms and supporting raw data. In addition to the hardcopy deliverable, contract laboratories must also submit the same data electronically. The laboratory must submit data to EPA within 7, 14, or 21-days after laboratory receipt of the last sample in set [or

preliminary data within 48 hours (for trace volatiles and volatiles) or 72 hours (for semivolatiles, pesticides, and Aroclors)] after laboratory receipt of each sample. EPA then processes the data through an automated Data Assessment Tool (DAT). DAT provides EPA Regions with PC-compatible reports, spreadsheets, and electronic files within 24-48 hours from the receipt of the data for use in data validation. This automated tool also facilitates the transfer of analytical data into Regional databases. In addition to the Regional electronic reports, the CLP laboratories are provided with a data assessment report that documents the instances of noncompliance. The laboratory has 6 business days to reconcile defective data and resubmit the data to EPA. EPA then reviews the data for noncompliance and sends a final data assessment report to the CLP laboratory and the Region.

QUALITY ASSURANCE (QA)

The QA process consists of management review and oversight at the planning, implementation, and completion stages of the environmental data collection activity. This process ensures that the data provided are of known and documented quality.

During the implementation of the data collection effort, QA activities ensure that the Quality Control (QC) system is functioning effectively and that the deficiencies uncovered by the QC system are corrected. After environmental data are collected, QA activities focus on assessing the quality of data to determine its suitability to support enforcement or remedial decisions.

Each contract laboratory prepares a Quality Assurance Plan (QAP) with the objective of providing sound analytical chemical measurements. The QAP must specify the policies, organization, objectives, and functional guidelines, as well as the QA and QC activities designed to achieve the data quality requirements in the contract.

QUALITY CONTROL (QC)

The QC process includes those activities required during analytical data collection to produce data of known and documented quality. The analytical data acquired from QC procedures are used to estimate and evaluate the analytical results and to determine the necessity for, or the effect of, corrective action procedures. The QC procedures required for this analytical service are provided in **Table 3**.

Table 2. Methods and Instruments

Fraction	Water	Soil
Trace Volatiles	Purge-and-trap followed by GC/MS analysis	N/A
Volatiles	Purge-and-trap followed by GC/MS analysis	Purge-and-trap or closed-system purge-and-trap followed by GC/MS analysis
Semivolatiles	Continuous liquid-liquid extraction (CLLE) followed by GC/MS analysis	Sonication, automated SDS extraction, or pressurized fluid extraction followed by GC/MS analysis
Pesticides	CLLE or separatory funnel extraction followed by dual column GC/ECD analysis	Sonication, automated SDS extraction or pressurized fluid extraction followed by dual column GC/ECD analysis
Aroclors	CLLE or separatory funnel extraction followed by dual column GC/ECD analysis	Sonication, automated SDS extraction or pressurized fluid extraction followed by dual column GC/ECD analysis

Table 3. Quality Control (QC)

QC Operation	Frequency
Deuterated Monitoring Compounds (DMCs) (trace volatiles, volatiles, and semivolatiles)	Added to each sample, standard, and blank
Surrogates (pesticides and Aroclors)	Added to each sample, standard, and blank
Method Blanks (trace volatiles and volatiles)	Analyzed at least every 12 hours for each matrix and level
Method Blanks (semivolatiles, pesticides, and Aroclors)	Prepared with each group of 20 samples or less of same matrix and level, or each time samples are extracted by the same procedure
Instrument Blank (trace volatiles and volatiles)	Analyzed after a sample which contains compounds at concentrations greater than the calibration range
Instrument Blank (pesticides and Aroclors)	Every 12 hours on each GC column used for analysis
Storage Blanks (trace volatiles and volatiles)	Prepared and stored with each set of samples
GC/MS Mass Calibration and Ion Abundance Patterns (trace volatiles, volatiles, and semivolatiles)	Every 12 hours for each instrument used for analysis
GC Resolution Check (pesticides)	Prior to initial calibration, on each instrument used for analysis
Initial Calibration	Upon initial set up of each instrument, and each time continuing calibration fails to meet the acceptance criteria
Continuing Calibration	Every 12 hours for each instrument used for analysis
Internal Standards (trace volatiles, volatiles, and semivolatiles)	Added to each sample, standard, and blank
Matrix Spike and Matrix Spike Duplicate (MS/MSD)	Once every 20 or fewer samples of same fraction, matrix, and level in a Sample Delivery Group (SDG)
Laboratory Control Samples (LCSs) (pesticides and Aroclors)	Once every 20 or fewer samples of same fraction, matrix, and level in an SDG
Method Detection Limit (MDL)	Determined annually, per matrix and level

PERFORMANCE MONITORING ACTIVITIES

Laboratory performance monitoring activities are provided primarily by ASB and the Regions to ensure that contract laboratories are producing data of the appropriate quality. EPA performs on-site laboratory audits, data package audits, GC/MS and/or GC/ECD tape audits, and evaluates laboratory performance through the use of blind Performance Evaluation (PE) samples.

CONTACTING EPA

For more information, or for suggestions to improve this analytical service, please contact:

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