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Technical Memorandum

To: Justine Barton, Environmental Review and Sediment Management Unit, EPA Region 10

From: Keith Strout, CB&I Federal Services, LLC, EPA QATS Program

Through: Shari Myer, QATS Program EPA Project Officer

Date: November 13, 2013

Subject: Development and Production of the Puget Sound Sediment Reference Material SR0431

1.0 Introduction

In cooperation with the United States Environmental Protection Agency (EPA) Region 10, and the EPA Analytical Services Branch (ASB) Office of Superfund Remediation and Technology Innovation (OSRTI), a Puget Sound Sediment Reference Material (SRM) was developed and produced at the Quality Assurance Technical Support (QATS) Laboratory in Las Vegas, Nevada. This SRM is designated as Puget Sound SRM SR0431. The QATS Laboratory is operated by Shaw Environmental, Inc., a CB&I Federal Services, LLC Company, under EPA Contract Number EP-W-10-033.

The Puget Sound SRM was prepared from marine sediment material sampled from Puget Sound in Washington State, and it was developed as a quality assurance (QA) material to assist in the verification and validation of measurement accuracy, and to evaluate and monitor laboratory performance when analyzing real-world samples collected from Puget Sound. The Puget Sound SRM was developed for use with high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS) extraction and analysis methods for chlorinated dibenzo-p-dioxin / chlorinated dibenzofuran (CDD/CDF) and chlorinated biphenyl congener (CBC) analytes, as well as for Aroclors using gas chromatography / electron capture detection (GC/ECD) methods. Certified values and advisory control limits for many of these organic analytes have been established for this QA material and are presented in this report. All of the analytes in Puget Sound SRM SR0431, for which certified values and advisory control limits have been established, were naturally present in the sediment material before processing.

This technical memo describes the production of the Puget Sound SRM at the EPA QATS Laboratory, including receipt and processing of the starting material, characterization, preliminary and round-robin analysis of the sediment, development of certified analyte values and advisory control limits, and packaging and storage of the finished Puget Sound SRM.

2.0 Origin and Receipt of the Puget Sound SRM Starting Material

Marine sediments from three different locations in Puget Sound, Washington were received at the QATS Laboratory in Las Vegas, Nevada on September 29, 2010. The starting sediment material sampling methods, activities, and locations are described in detail in the EPA document “Field Sampling Report for the Puget Sound Sediment Reference Material Development Project”, July 29, 2011. Another informative document related to the development of the Puget Sound SRM is the EPA

document “Quality Assurance Project Plan for the Puget Sound Sediment Reference Material Development Project”, May 3, 2010. The initial intent of using sediments from three different locations in Puget Sound as starting materials was to use a combination of the three materials to create the final SRM with the desired concentrations of CDD/CDF and CBC analytes. One of the sampling locations was targeted because the sediment was suspected of containing Aroclor/CBC analytes, the second sampling location was targeted because the sediment was suspected of containing CDD/CDF analytes, and the third location was targeted because the sediment was thought to be relatively free of CDD/CDF and CBC analytes and could potentially be used as a diluent to prepare the final SRM.

The sediment materials were shipped overnight and received in sealed and intact five-gallon plastic buckets, which were labeled and accompanied by chain-of-custody documentation containing the appropriate identification and tracking information. A total of 27 five-gallon buckets of the three different sediment materials were received and logged into the QATS Laboratory sample management system (see Appendix 1 – Photos 1, 2, & 3). The three different sediments were assigned unique lot numbers for identification and tracking purposes. The 27 buckets of sediment material were sampled from the following locations in Puget Sound:

- 10 Buckets from the Lower Duwamish Waterway/T-117 in Seattle, Washington suspected of containing Aroclor/CBC analytes.
- 13 Buckets from Budd Inlet near Olympia, Washington suspected of containing CDD/CDF analytes.
- 4 Buckets from Raft Island in Carr Inlet near Gig Harbor, Washington suspected of containing no CBC or CDD/CDF analytes.

Table 1 below presents the starting sediment materials identification and quantity information upon receipt. The net wet weight of each bucket was obtained by recording the gross weight of each bucket and subtracting the weight of the empty bucket after removal of the sediment. The total net wet weight of each sediment type was derived by summing the net wet weights of the individual bucket contents.

Table 1: Puget Sound SRM Starting Sediment Materials Receipt Information

Sediment Sampling Location	Assigned Lot Number	Total Number of 5-Gallon Buckets	Total Net Wet Weight Received	Total Net Wet Weight After Decanting H_2O
Carr Inlet	SR0412	4	114 Kg	103 Kg
Budd Inlet	SR0413	13	297 Kg	289 Kg
T-117	SR0414	10	259 Kg	230 Kg
Total	NA	27	670 Kg	622 Kg

3.0 Processing of the Puget Sound SRM Starting Material

The three starting sediment materials were processed separately and independently to avoid cross-contamination of the materials. The order of processing for the starting sediment materials was Carr Inlet, followed by Budd Inlet, then T-117, and each sediment type was processed in an identical manner. The first step in processing the starting sediment materials was to open all of the containers for each sediment type and decant the water from the top of the sediment material. Following decanting, the sediment material was removed from the buckets and distributed into labeled, tared, high-density polyethylene (HDPE) trays to promote air-drying of the sediment material. Each of the

trays containing the sediment was weighed to obtain the gross weight of the tray containing the sediment. The net wet weight of the sediment material of each tray was determined by subtracting the tare weight. The total net wet weight of each starting sediment material received is illustrated in Table 1. The sediment location identification and weight information were recorded on the tray label and in the sample processing logbook.

After distributing the wet sediment from the three sampling locations into HDPE trays, the three starting sediment materials were placed in three separate laboratory areas designated for each sediment type to commence the air-drying processing phase (see Appendix 1 – Photo 4). The temperature in the laboratories was maintained at 80^{O} F, and the relative humidity was less than 10 percent during the sediment processing drying phase. The fume hoods in the laboratories were left on during the drying phase to remove the excess moisture from the environment. Cross-cut patterns were made in the sediment in each tray to increase the surface area of the sediment exposed to the air to promote drying. The starting sediment materials were allowed to dry for a period of two weeks. During the two-week time period as the starting sediment materials continuously lost moisture, the sediment in the trays was broken up with a ceramic pestle, and chopped into smaller pieces with stainless steel utensils, and was repeatedly turned over to promote evaporation of the water. Sample weighing results indicated that the sediments lost over 70 percent of their moisture content during the first three days of the drying phase. After two weeks of air-drying and chopping, the starting sediment materials appeared to be dry and free-flowing, and the sediment material particles ranged from less than 63 µm to gravel-size particles (see Appendix 1 – Photo 5).

Subsequent to air-drying the starting sediment materials in trays, each of the sediment types was tumbled in a stainless-steel V-blender in multiple batches to further reduce the particle size of the sediment material. Zirconia grinding pellets were added to the V-blender batches to promote particle size reduction. After the sediment material was processed in the V-blender, it was distributed back into the HDPE trays for further drying over a one-week period. The sediment material was turned-over in the trays with stainless steel utensils several times daily to promote drying. Samples of the three dried sediment materials were selected for loss on drying determinations, the results of which are listed in the Table 2 “Loss on Drying – Final” row.

All of the dried material from each of the sediment types was separately combined and blended in a rotary blender for a period of 24 hours and sampled for preliminary analysis. The bulk material was removed from the blender and distributed into clean 5-gallon plastic buckets (see Appendix 1 – Photos 6, 7, & 8). After all three of the sediment materials were processed in the rotary blender and sampled, the three different sediment materials were subjected to preliminary analysis to determine primarily the concentrations of CDD/CDF and Aroclor analytes in the sediment materials. Additional physical parameters of the sediment material were determined, including water content of the original decanted sediment, particle size, final loss on drying, total organic carbon (TOC), and loss on ignition.

4.0 Preliminary Analysis of the Puget Sound SRM Starting Material

Preliminary analysis of Puget Sound SRM starting materials was performed subsequent to the drying and individual batch blending of the three different sediments. Analysis for Aroclors, water content of the original decanted sediments, particle size, final loss on drying, and loss on ignition was performed or determined at the QATS Laboratory. Analysis for CDD/CDF analytes and TOC was performed by a commercial laboratory.

Particle size was determined by sieve analysis using a series of decreasing size US Standard Testing Sieves (ASTM E-11) employing a Ro-Tap Model RX-29 sieve analysis testing device (see Appendix 1 –

Photo 9). Loss on drying and loss on ignition determinations were performed using QATS Laboratory standard operating procedures (SOPs), and TOC analysis was performed using EPA Method 9060A. Aroclor analysis was performed using the EPA Contract Laboratory Program (CLP) SOM01.2 Statement of Work (SOW), and CDD/CDF analysis was performed using the EPA CLP DLM02.2 SOW.

Table 2 below presents the physical property determinations for the three starting sediment materials.

Table 2: Physical Properties of Puget Sound SRM Starting Sediment Materials

Physical Property	Carr Inlet Sediment Lot No. SR0412	Budd Inlet Sediment Lot No. SR0413	T-117 Sediment Lot No. SR0414
Net Dry Weight	69 Kg	101 Kg	111 Kg
Original Water Content	32%	65%	52%
Loss on Drying - Final	0.80%	2.4%	2.8%
Loss on Ignition	3.3%	13.8%	9.4%
Total Organic Carbon	0.56%	2.6%	1.9%
Sieve Analysis	**Carr Inlet Sediment Lot No. SR0412**	**Budd Inlet Sediment Lot No. SR0413**	**T-117 Sediment Lot No. SR0414**
> 20 Mesh US Sieve	0.0%	0.0%	0.0%
> 45 Mesh US Sieve	0.5%	1.0%	3.0%
> 60 Mesh US Sieve	1.0%	1.0%	2.5%
> 80 Mesh US Sieve	1.0%	2.0%	3.0%
> 100 Mesh US Sieve	0.5%	2.0%	2.0%
> 120 Mesh US Sieve	1.0%	3.0%	4.0%
> 200 Mesh US Sieve	12.5%	12.0%	17.0%
> 230 Mesh US Sieve	11.0%	10.0%	19.0%
< 230 Mesh US Sieve	72.5%	69.0%	49.5%

Table 3 below presents the preliminary Aroclor concentrations for the three starting sediment materials.

Table 3: Aroclor Concentrations of Puget Sound SRM Starting Sediment Materials

Aroclor	RQL (ug/Kg)	Carr Inlet Sediment Lot No. SR0412 (ug/Kg)	Budd Inlet Sediment Lot No. SR0413 (ug/Kg)	T-117 Sediment Lot No. SR0414 (ug/Kg)
Aroclor 1016	33	33 U*	33 U	33 U
Aroclor 1221	33	33 U	33 U	33 U
Aroclor 1232	33	33 U	33 U	33 U
Aroclor 1242	33	33 U	33 U	33 U
Aroclor 1248	33	33 U	33 U	33 U
Aroclor 1254	33	33 U	33 U	33 U
Aroclor 1260	33	33 U	33 U	75
Aroclor 1262	33	33 U	33 U	33 U
Aroclor 1268	33	33 U	33 U	33 U

*U = Not detected above the required quantitation limit (RQL)

Table 4 below presents the preliminary CDD/CDF concentrations and total toxic equivalency (TEQ) for the three starting sediment materials.

Table 4: CDD/CDF Concentrations of Puget Sound SRM Starting Sediment Materials

CDD/CDF Analyte	RQL (ng/Kg)	Carr Inlet Sediment Lot No. SR0412 (ng/Kg)	Budd Inlet Sediment Lot No. SR0413 (ng/Kg)	T-117 Sediment Lot No. SR0414 (ng/Kg)
1,2,3,4,6,7,8-HpCDD	2.5	12.7	352	79.7
1,2,3,4,6,7,8-HpCDF	2.5	3.90	136	21.1
1,2,3,4,7,8,9-HpCDF	2.5	0.45 J**	5.64	1.97 J
1,2,3,4,7,8-HxCDD	2.5	0.88 J	7.42	1.49 J
1,2,3,4,7,8-HxCDF	2.5	1.49 J	16.3	3.41
1,2,3,6,7,8-HxCDD	2.5	1.03 J	21.8	4.23
1,2,3,6,7,8-HxCDF	2.5	0.37 J	5.68	1.58 J
1,2,3,7,8,9-HxCDD	2.5	0.87 J	11.4	2.74
1,2,3,7,8,9-HxCDF	2.5	2.50 U*	1.79 J	0.57 J
1,2,3,7,8-PeCDD	2.5	0.57 J	3.99	0.82 J
1,2,3,7,8-PeCDF	2.5	1.22 J	7.20	1.20 J
2,3,4,6,7,8-HxCDF	2.5	1.35 J	13.3	2.36 J
2,3,4,7,8-PeCDF	2.5	2.50 U	2.35 J	0.86 J
2,3,7,8-TCDD	0.5	1.30	5.61	1.18 J
2,3,7,8-TCDF	0.5	0.70	3.24	0.81 J
OCDD	5.0	91.3	2960	737
OCDF	5.0	7.84	216	64.1
Total HpCDD	-----	33.8	918	214
Total HpCDF	-----	9.42	347	74.8
Total HxCDD	-----	11.1	199	35.6
Total HxCDF	-----	6.94	193	36.6
Total PeCDD	-----	4.05	40.2	7.83
Total PeCDF	-----	3.79	64.4	19.0
Total TCDD	-----	5.45	33.1	6.46
Total TCDF	-----	7.71	44.5	15.6
Total TEQ Mammal	-----	2.77	24.5	5.28
Total TEQ Fish	-----	2.81	21.1	4.53
Total TEQ Bird	-----	3.22	23.4	5.36

* U = Not detected above the required quantitation limit (RQL)
**J = Estimated concentration
Note: TEQ results are based on the Toxic Equivalency Factors from the World Health Organization (Mammal 2005, Fish and Bird 1998).

Based on the preliminary analysis results, the Puget Sound SRM Interagency Workgroup decided that the T-117 sediment from the Lower Duwamish Waterway contained CDD/CDF and Aroclor analytes within the ideal, low-level targeted range for these chemicals-of-concern (COC) for the final SRM (4 to 10 ng/Kg TEQ for CDD/CDF and 70 to 130 ug/Kg for Aroclors, both based on dry weight). Therefore, additional processing was conducted only on the T-117 sediment to create the finished Puget Sound

SRM. Furthermore, based on the sieve analysis results and the recommendation of QATS Laboratory personnel, the Puget Sound SRM Interagency Workgroup decided that only the dried, blended T-117 sediment that passed through a 60 Mesh US Standard Testing Sieve (250 µm) would be used to compose the final SRM. The entire batch of dried, blended T-117 sediment material was processed using a 60 Mesh sieve, which removed most of the shell fragments and material which appeared to be small pieces of tree bark (see Appendix 1 – Photo 10). The T-117 material which passed through the 60 Mesh sieve was again blended in a rotary mixer for 24 hours and sampled for round-robin study analysis. The bulk material, approximately 100 Kg, was removed from the blender and distributed into clean 5-gallon plastic buckets until further processing (see Appendix 1 – Photo 11). The final Puget Sound SRM was re-designated as Lot Number SR0431.

5.0 Round-Robin Study Analysis of the Final Puget Sound SRM

Round-robin study analysis was performed on the final Puget Sound SRM for CDD/CDF, CB Congener, and Aroclor analytes since these are the regionally relevant COCs. Aroclor round-robin analysis was performed on the final SRM through the CLP quarterly-blind (QB) performance evaluation sample (PES) testing program using 11 commercial CLP laboratories and the QATS Laboratory, for a total of 12 laboratories, using the CLP SOM01.2 SOW. The raw data submitted by the laboratories were reviewed for identification and quantitation validity using the criteria in the CLP SOM01.2 SOW, as well as the USEPA CLP National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (June 2008). Aroclor 1260 was the only target Aroclor positively identified and reported. The average Aroclor result and associated statistics and calculated advisory control limits from the QB round-robin study are presented in Appendix 2, Table A2-1. The Grubbs' Test for outliers was performed on the submitted data (alpha value = 0.05 significance level) and there were no statistical outliers detected in the data set. The QATS Program maintains a historic database of results and statistics derived from the QB round-robin events. Based on these historical statistics, the RSD value of 27.1 percent derived from this QB round-robin event was within the expected range for Aroclors in soil. Upon consultation with the Puget Sound SRM Interagency Workgroup, the control limits for Aroclor 1260 in Puget Sound SRM SR0431 were set using the calculated 95% confidence interval around the average concentration.

In addition to reporting detected results for Aroclor 1260, 2 of the 12 laboratories reported detected results for Aroclor 1254 at concentrations of 49 and 64 ug/Kg, and a third laboratory reported detected results for Aroclor 1248 at a concentration of 49 ug/Kg. Using the criteria in the analytical method, as well as the NFG cited above, the reported results for Aroclor 1248 and Aroclor 1254 could not be authenticated upon review. Based on the round-robin study results and statistics, Aroclor 1260 is the only Aroclor in the Puget Sound SRM with a certified average value and advisory control limits. Reported detected results for any other Aroclors in the Puget Sound SRM should be classified as "not evaluated", unless they are mis-identifications of Aroclor 1260, or if they can be classified as false positive results based on blank sample or other QA sample results. In either case, the non-Aroclor 1260 results should be qualified appropriately.

CDD/CDF round-robin analysis was performed on the final SRM by 10 commercial laboratories capable of performing HRGC/HRMS CDD/CDF analysis using the procedures and guidelines in the CLP DLM02.2 SOW, EPA Method 8290A, or EPA Method 1613B. The raw data submitted by the laboratories were reviewed for identification and quantitation validity using the criteria in the CDD/CDF analytical methods cited above, as well as the USEPA CLP NFG for CDD/CDF Data Review (September 2011). All 17 of the 2,3,7,8-chlorinated target CDD/CDF analytes were detected and reported by the laboratories, with the exception of an undetected 1,2,3,7,8,9-HxCDF result from one laboratory. The average results and associated statistics and calculated advisory control limits from the CDD/CDF round-robin study, for all of the target CDD/CDF analytes, are presented in Appendix 2,

Table A2-2. The Grubbs' Test for outliers was performed on the submitted data (alpha value = 0.05 significance level) and there were no statistical outliers detected in the data set. Based on the QATS Program historical statistics, the RSD values for the CDD/CDF analytes derived from this round-robin study were within the expected range for CDD/CDF analytes in soil. Upon consultation with the Puget Sound SRM Interagency Workgroup, the control limits for all of the 2,3,7,8-chlorinated target CDD/CDF analytes were set using ± 50 percent around the average concentration of each analyte. Table A2-3 presents the TEQ based on the average concentrations of the CDD/CDF congeners and the respective World Health Organization (WHO) toxic equivalency factors (TEF).

CB Congener round-robin analysis was performed on the final SRM by eight commercial laboratories capable of performing HRGC/HRMS CB Congener analysis using the procedures and guidelines in the CLP SOW CBC01.2 or EPA Method 1668C. The raw data submitted by the laboratories were reviewed for identification and quantitation validity using the criteria in the CB Congener analytical methods cited above, as well as QATS Program SOPs for data review. The average results and associated statistics and calculated advisory control limits from the CB Congener round-robin study, for the non co-eluting target CB Congener analytes, are presented in Appendix 2, Table A2-4. The average results and associated statistics and calculated advisory control limits from the CB Congener round-robin study, for the co-eluting target CB Congener analytes, are presented in Appendix 2, Table A2-5. The Grubbs' Test for outliers was performed on the submitted data (alpha value = 0.05 significance level) and 2.8 percent of the submitted results were determined to be statistical outliers and were rejected from the data set. Based on the QATS Program historical statistics, the RSD values for the CBC analytes derived from this round-robin study were within the expected range for CBC analytes in soil. Upon consultation with the Puget Sound SRM Interagency Workgroup, the control limits for all of the CB Congener target analytes were set using ± 50 percent around the average concentration of each analyte or co-eluting analytes. In column 4 of Tables A2-4 and A2-5, we have denoted with a "Y" specific CB Congeners known to be constituents of Aroclor 1260, which has been determined to be a chemical component of the SRM. Table A2-6 presents the TEQ based on the average concentrations of the CB Congeners and the respective WHO TEFs.

6.0 Bottling and Storage of the Puget Sound SRM

The 100 Kg of the final Puget Sound SRM, Lot Number SR0431, was bottled into 30 cc (one-ounce) amber glass bottles, with each bottle containing between 33 and 35 grams of SRM (see Appendix 1 – Photo 12). The bottles (approximately 2,800) are sealed with Teflon-lined screw caps, and they are stored in a freezer maintained at -20^{O} C at the QATS facility in Las Vegas, NV. Requests for the Puget Sound SRM should be submitted by authorized requestors to the Puget Sound SRM Manager, in accordance with the "Puget Sound Sediment Reference Material: Guidance for Distribution and Reporting" document (Rev. 3/27/2013). Examples of the Puget Sound SRM request form and the Puget Sound SRM analytical instructions are provided as Appendix 3 of this report.

7.0 Summary, Conclusions, and Recommendations

In cooperation with the EPA Region 10 and the EPA ASB OSRTI, a Puget Sound Sediment Reference Material was developed and produced at the QATS Laboratory in Las Vegas, Nevada. This SRM is designated as Puget Sound SRM SR0431. This technical memo describes the production of the Puget Sound SRM at the EPA QATS Laboratory, including receipt and processing of the starting material, characterization, screening and round-robin analysis of the sediment, development of certified analyte values and advisory control limits, and packaging and storage of the finished Puget Sound SRM.

The final Puget Sound SRM was prepared from marine sediment sampled from the Lower Duwamish Waterway/T-117 in Puget Sound in Washington State, and was developed as a QA material to assist in the verification and validation of measurement accuracy, and to evaluate and monitor laboratory performance when analyzing real-world samples collected from Puget Sound. The Puget Sound SRM was developed for use with HRGC/HRMS extraction and analysis methods for CDD/CDF and CBC analytes, as well as for Aroclors GC/ECD methods. Certified values and advisory control limits for Aroclor 1260, the 17 2,3,7,8-chlorinated CDD/CDF congeners, and many of the 209 CBC analytes have been established for this QA material and are presented in this report. All of the analytes in Puget Sound SRM SR0431 for which certified values and advisory control limits have been established were naturally present in the sediment material before processing.

The inventory of Puget Sound SRM is presently being stored in a freezer at -20^{O} C. It is recommended that when the SRM is received at laboratories, it be stored in the dark at ≤ 6^{O} C, preferably at < 0^{O} C, until extraction and analysis of the material. Unused SRM can be retained for future extraction and analysis, provided that it is stored under the recommended conditions.

The control limits presented in this technical memorandum for Aroclor 1260, CDD/CDF analytes, and CBC analytes are advisory limits which were established from the data derived solely from the round-robin studies referenced in this report. It is recommended that the control limits be continually reassessed and recalculated when 25 to 30 additional data points for each analytical fraction are obtained from the use of this SRM. Data derived from the use of the Puget Sound SRM should also be used to assess the stability and ongoing integrity of the SRM.

8.0 References

Field Sampling Report for the Puget Sound Sediment Reference Material Development Project, USEPA, July 29, 2011.

Quality Assurance Project Plan for the Puget Sound Sediment Reference Material Development Project, USEPA, May 3, 2010.

USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, SOM01.2, February, 2007.

USEPA Analytical Services Branch Statement of Work for Analysis of Chlorinated Dibenzo-p-dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs), Multi-Media, Multi-Concentration, DLM02.2, December, 2009.

USEPA Analytical Services Branch Statement of Work for Analysis of Chlorinated Biphenyl Congeners (CBCs), Multi-Media, Multi-Concentration, CBC01.2, December, 2009.

USEPA SW-846 Method 8290A Polychlorinated Dibenzo-p-dioxins (CDDs) and Polychlorinated Dibenzofurans (CDFs) by High Resolution Gas Chromatography / High Resolution Mass Spectrometry (HRGC/HRMS), Revision 1, February, 2007.

USEPA Method 1613B Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS, October, 1994.

USEPA Method 1668C Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS, April, 2010.

USEPA Method 9060A Total Organic Carbon, November, 1994.

USEPA CLP National Functional Guidelines for Superfund Organic Methods Data Review, June, 2008.

USEPA CLP National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review, September, 2011.

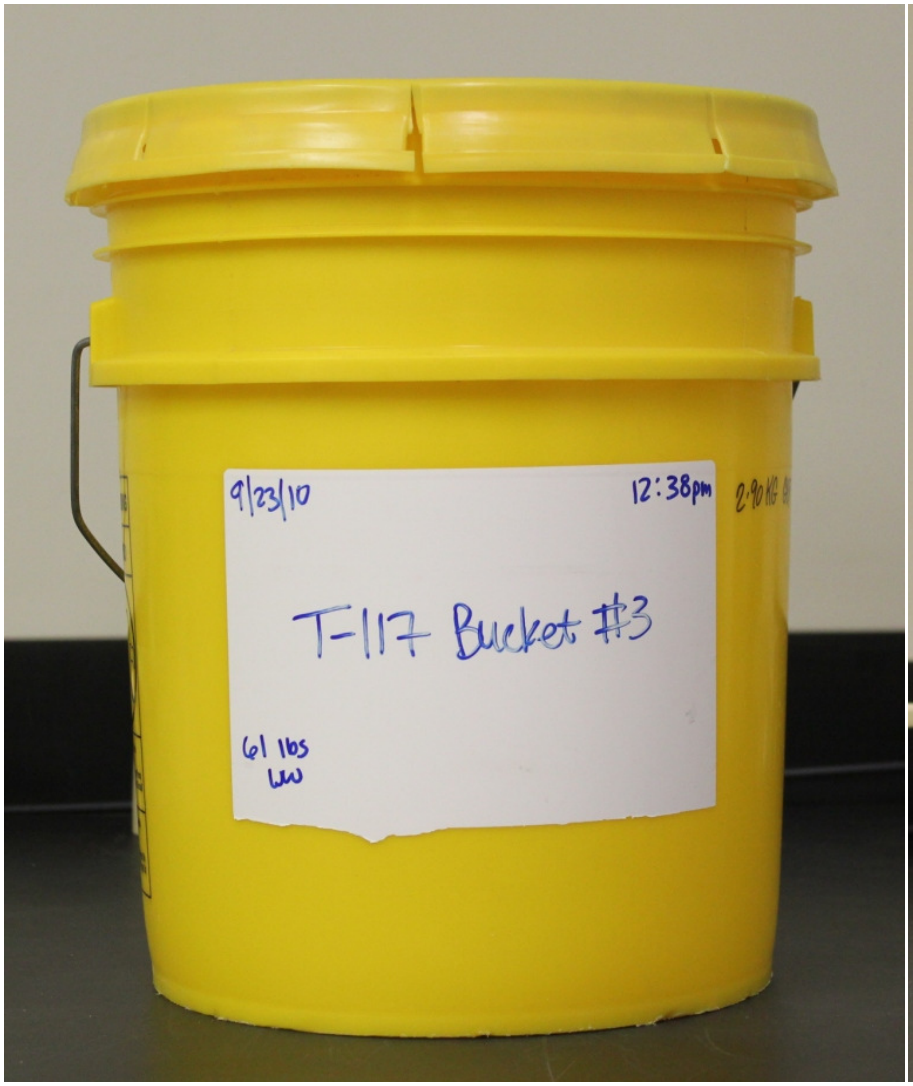

Photo 1 – Example sediment bucket from the T-117 site

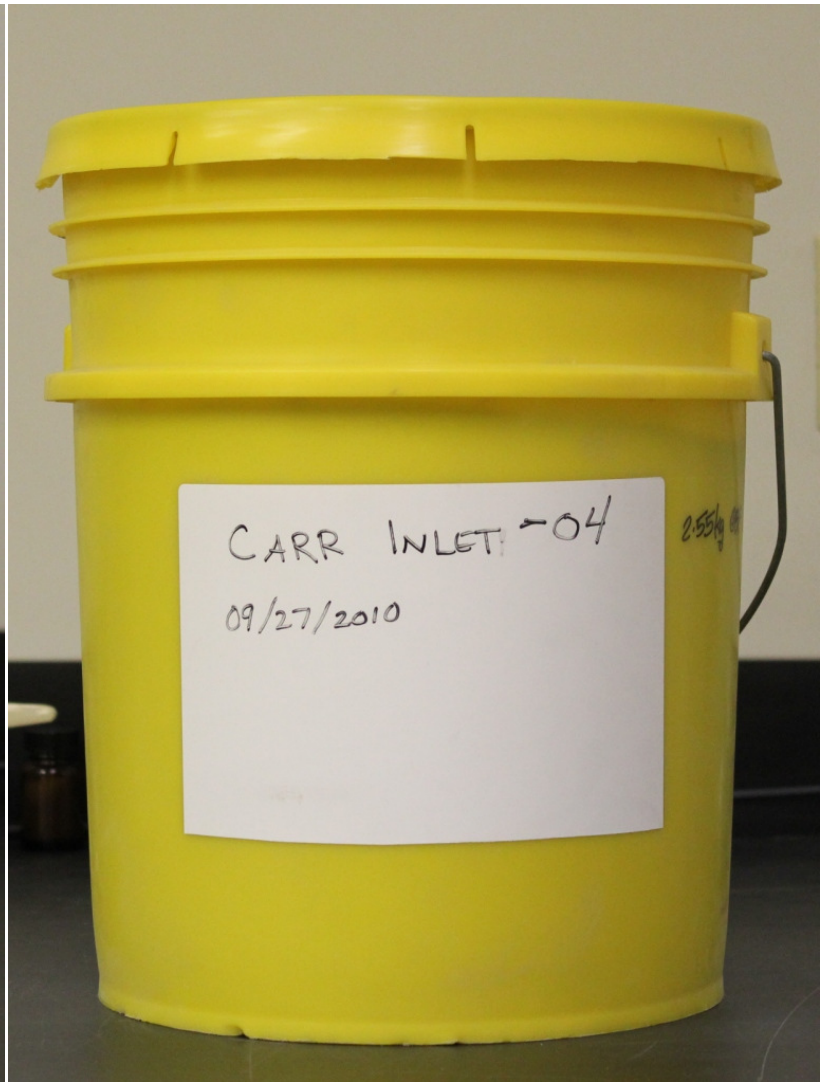

Photo 2 – Example sediment bucket from the Carr Inlet site

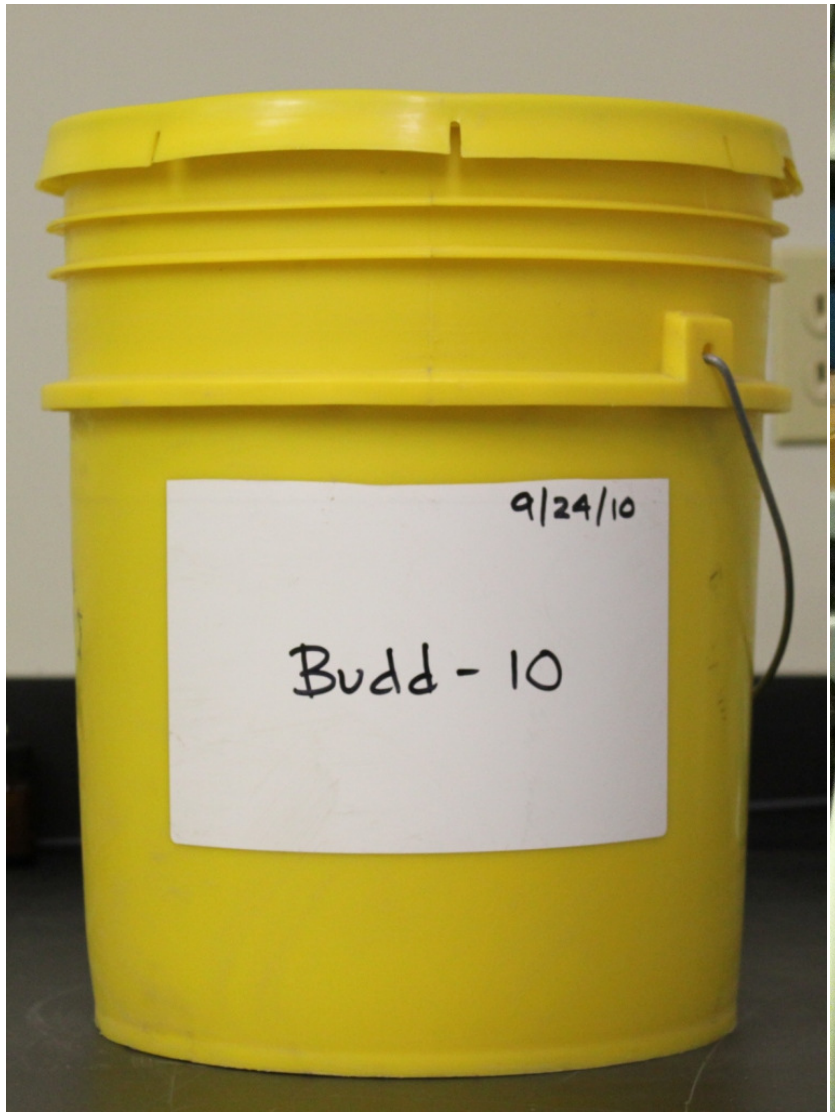

Photo 3 – Example sediment bucket from the Budd Inlet site

Photo 4 – Wet sediment in HDPE trays for drying

Photo 5 – Example of sediment prior to V-blending

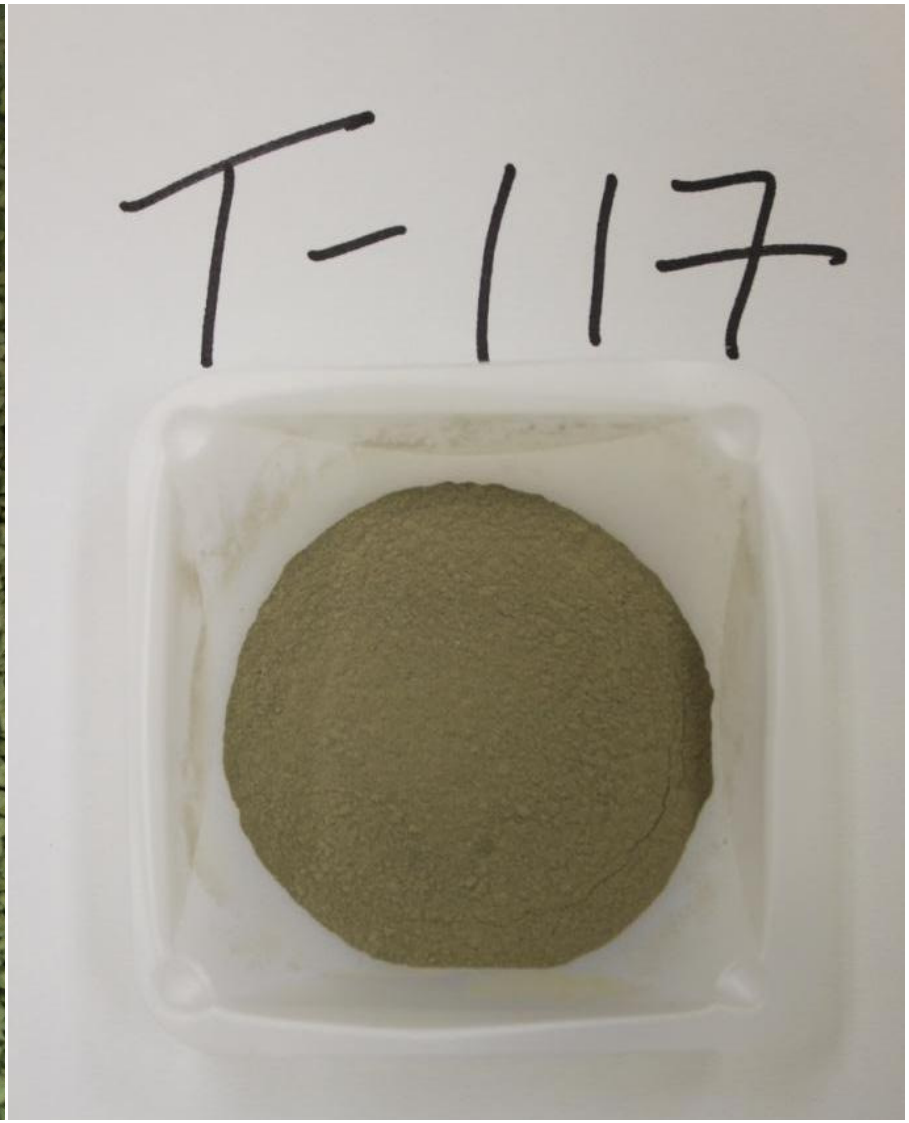

Photo 6 – T-117 sediment after rotary batch blending

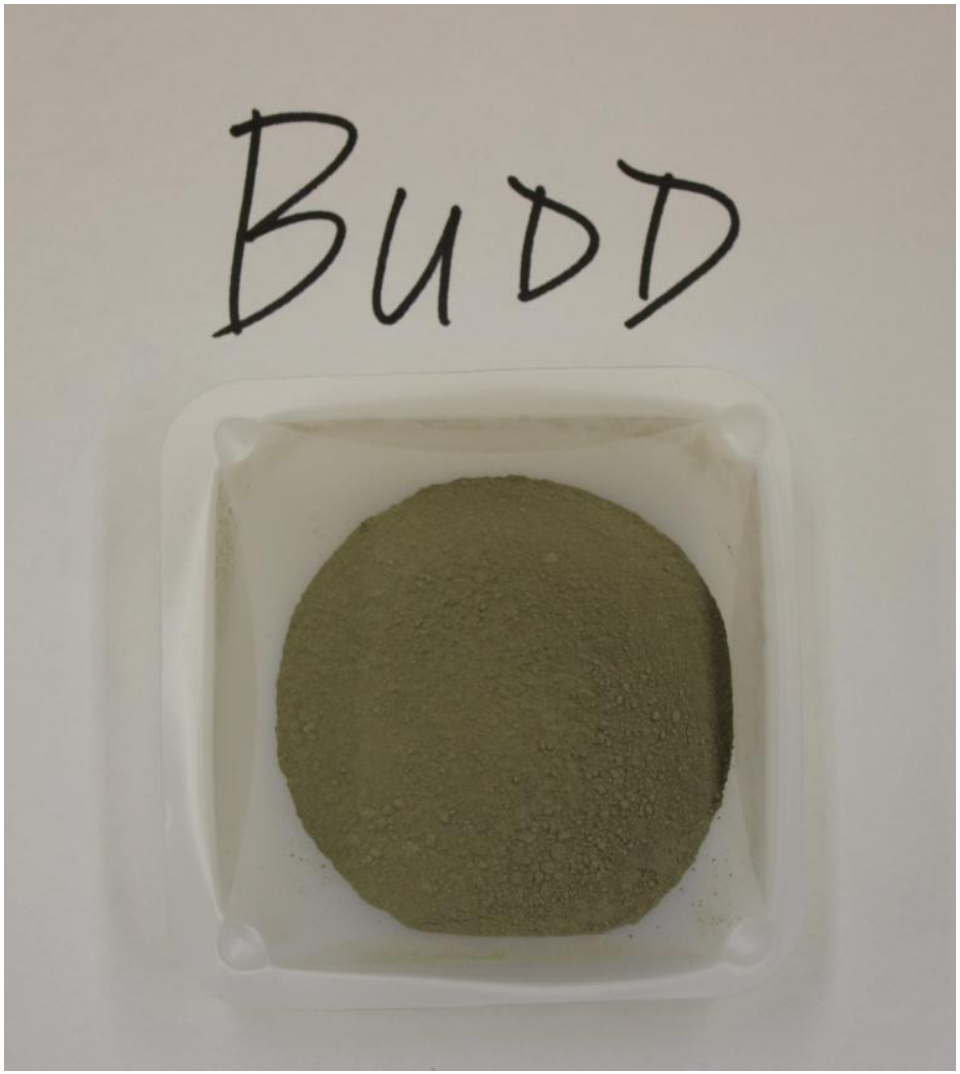

Photo 7 – Budd Inlet sediment after rotary batch blending

Photo 8 – Carr Inlet sediment after rotary batch blending

Photo 9 – Sieve analysis on Ro-Tap Model RX-29 device

Photo 10 – Excluded T-117 material > 60 Mesh US Sieve

Photo 11 – Final bulk Puget Sound SRM (< 60 Mesh US Sieve) after rotary blending

Photo 12 – Final bottled and labeled Puget Sound SRM

Table A2-1: Composite Laboratory Results and Advisory Control Limits - Aroclors

	Aroclor Target Analyte	CAS No.	QL ug/Kg	Avg. Conc. ug/Kg	SD ug/Kg	RSD	Min ug/Kg	Max ug/Kg	n	Advisory Control Limits (ug/Kg)	
										Low	High
1	Aroclor 1016	12674-11-2	33	33 U*	-----	-----	-----	-----	-----	-----	-----
2	Aroclor 1221	11104-28-2	33	33 U	-----	-----	-----	-----	-----	-----	-----
3	Aroclor 1232	11141-16-5	33	33 U	-----	-----	-----	-----	-----	-----	-----
4	Aroclor 1242	53469-21-9	33	33 U	-----	-----	-----	-----	-----	-----	-----
5	Aroclor 1248	12672-29-6	33	33 U	-----	-----	-----	-----	-----	-----	-----
6	Aroclor 1254	11097-69-1	33	33 U	-----	-----	-----	-----	-----	-----	-----
7	Aroclor 1260	11096-82-5	33	108	29	27.1	59	150	12	41	180
8	Aroclor 1262	37324-23-5	33	33 U	-----	-----	-----	-----	-----	-----	-----
9	Aroclor 1268	11100-14-4	33	33 U	-----	-----	-----	-----	-----	-----	-----

*U = Not detected above the required quantitation limit (RQL)

Table A2-2: Composite Laboratory Results and Advisory Control Limits – CDD/CDF Analytes

No.	CDD/CDF Target Analyte	CAS No.	QL ng/Kg	Avg. Conc. ng/Kg	SD ng/Kg	RSD	Min ng/Kg	Max ng/Kg	n	Advisory Control Limits (ng/Kg)	
										Low	High
1	2,3,7,8-TCDD	1746-01-6	1.0	1.05	0.25	24.1	0.695	1.50	10	0.525	1.57
2	1,2,3,7,8-PeCDD	40321-76-4	5.0	1.08	0.39	35.6	0.630	1.72	10	0.542	1.63
3	1,2,3,4,7,8-HxCDD	39227-28-6	5.0	1.59	0.46	28.6	0.930	2.43	10	0.797	2.39
4	1,2,3,6,7,8-HxCDD	67653-85-7	5.0	3.88	0.73	18.7	2.35	4.72	10	1.94	5.82
5	1,2,3,7,8,9-HxCDD	19408-74-3	5.0	3.04	0.74	24.3	1.47	3.80	10	1.52	4.55
6	1,2,3,4,6,7,8-HpCDD	35822-46-9	5.0	90.6	12.78	14.1	64.0	106	10	45.3	136
7	OCDD	3268-87-9	10.0	811	106.51	13.1	620	937	10	406	1217
8	2,3,7,8-TCDF	51207-31-9	1.0	1.11	0.50	44.8	0.688	2.10	10	0.557	1.67
9	1,2,3,7,8-PeCDF	57117-41-6	5.0	1.23	0.57	46.5	0.794	2.65	10	0.613	1.84
10	2,3,4,7,8-PeCDF	57117-31-4	5.0	1.07	0.41	38.5	0.673	2.01	10	0.533	1.60
11	1,2,3,4,7,8-HxCDF	70648-26-9	5.0	3.02	0.58	19.3	2.17	3.81	10	1.51	4.53
12	1,2,3,6,7,8-HxCDF	57117-44-9	5.0	1.09	0.33	29.9	0.680	1.61	10	0.545	1.64
13	1,2,3,7,8,9-HxCDF	72918-21-9	5.0	0.511	0.35	68.3	0.071	1.16	9	0.255	0.77
14	2,3,4,6,7,8-HxCDF	60851-34-5	5.0	1.83	0.59	32.3	1.04	2.78	10	0.917	2.75
15	1,2,3,4,6,7,8-HpCDF	67562-39-4	5.0	18.7	2.94	15.7	13.8	22.1	10	9.36	28.1
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	5.0	1.63	0.44	27.3	1.14	2.42	10	0.815	2.44
17	OCDF	39001-02-0	10.0	58.4	8.99	15.4	45.0	71.0	10	29.2	87.6

Table A2-3: Toxic Equivalency (TEQ) Based on Composite Laboratory Results – CDD/CDF Analytes

No.	CDD/CDF Target Analyte	CAS No.	Avg. Conc. ng/Kg	TEF* Mammals	TEF Adj. Conc.** Mammals ng/Kg	TEF Fish	TEF Adj. Conc. Fish ng/Kg	TEF Birds	TEF Adj. Conc. Birds ng/Kg
1	2,3,7,8-TCDD	1746-01-6	1.05	1.0	1.05	1.0	1.05	1.0	1.05
2	1,2,3,7,8-PeCDD	40321-76-4	1.08	1.0	1.08	1.0	1.08	1.0	1.08
3	1,2,3,4,7,8-HxCDD	39227-28-6	1.59	0.1	0.159	0.5	0.795	0.05	0.079
4	1,2,3,6,7,8-HxCDD	67653-85-7	3.88	0.1	0.388	0.01	0.039	0.01	0.039
5	1,2,3,7,8,9-HxCDD	19408-74-3	3.04	0.1	0.304	0.01	0.030	0.1	0.304
6	1,2,3,4,6,7,8-HpCDD	35822-46-9	90.6	0.01	0.906	0.001	0.091	0.001	0.091
7	OCDD	3268-87-9	811	0.0003	0.243	0.0001	0.081	0.0001	0.081
8	2,3,7,8-TCDF	51207-31-9	1.11	0.1	0.111	0.05	0.056	1.0	1.11
9	1,2,3,7,8-PeCDF	57117-41-6	1.23	0.03	0.037	0.05	0.062	0.1	0.123
10	2,3,4,7,8-PeCDF	57117-31-4	1.07	0.3	0.321	0.5	0.535	1.0	1.07
11	1,2,3,4,7,8-HxCDF	70648-26-9	3.02	0.1	0.302	0.1	0.302	0.1	0.302
12	1,2,3,6,7,8-HxCDF	57117-44-9	1.09	0.1	0.109	0.1	0.109	0.1	0.109
13	1,2,3,7,8,9-HxCDF	72918-21-9	0.511	0.1	0.051	0.1	0.051	0.1	0.051
14	2,3,4,6,7,8-HxCDF	60851-34-5	1.83	0.1	0.183	0.1	0.183	0.1	0.183
15	1,2,3,4,6,7,8-HpCDF	67562-39-4	18.7	0.01	0.187	0.01	0.187	0.01	0.187
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	1.63	0.01	0.016	0.01	0.016	0.01	0.016
17	OCDF	39001-02-0	58.4	0.0003	0.018	0.0001	0.006	0.0001	0.006
TEQ					5.465		4.673		5.881

* TEF = Toxic Equivalency Factor from World Health Organization (WHO) (Mammal 2005, Fish and Bird 1998).

** TEF Adj. Conc. = Adjusted concentration of each congener based on the product of the detected concentration and the respective TEF.

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
1	2-Chlorobiphenyl	2.0	Y	23	2.6	11.2	19.5	26.6	6	12	35
2	3-Chlorobiphenyl	2.0		Not Detected							
3	4-Chlorobiphenyl	2.0		25	8.4	33.6	17.0	42.0	8	13	38
4	2,2'-Dichlorobiphenyl	2.0	Y	114	16.5	14.5	93.3	131	7	57	171
5	2,3-Dichlorobiphenyl	2.0		Not Detected							
6	2,3'-Dichlorobiphenyl	2.0	Y	169	30.4	17.9	122	200	8	85	254
7	2,4-Dichlorobiphenyl	2.0		17	3.3	19.8	10.9	20.0	7	8.4	25
8	2,4'-Dichlorobiphenyl	2.0	Y	366	65.5	17.9	253	460	8	183	548
9	2,5-Dichlorobiphenyl	2.0		20	4.0	20.5	14.0	26.0	7	10	29
10	2,6-Dichlorobiphenyl	2.0		Not Detected							
11	3,3'-Dichlorobiphenyl	2.0		74	10.5	14.3	60.0	91.0	6	37	110
12	3,4-Dichlorobiphenyl	2.0		Co-elutes with CBC #13 (See Table A2-5)							
13	3,4'-Dichlorobiphenyl	2.0		Co-elutes with CBC #12 (See Table A2-5)							
14	3,5-Dichlorobiphenyl	2.0		Not Detected							
15	4,4'-Dichlorobiphenyl	2.0	Y	308	36.5	11.8	272	380	7	154	462
16	2,2',3-Trichlorobiphenyl	2.0	Y	212	21.3	10.0	170	239	8	106	318
17	2,2',4-Trichlorobiphenyl	2.0	Y	363	31.7	8.7	310	405	8	182	545
18	2,2',5-Trichlorobiphenyl	2.0	Y	Co-elutes with CBC #30 (See Table A2-5)							
19	2,2',6-Trichlorobiphenyl	2.0		68	9.7	14.3	57.7	85.9	8	34	102
20	2,3,3'-Trichlorobiphenyl	2.0		Co-elutes with CBC #28 (See Table A2-5)							
21	2,3,4-Trichlorobiphenyl	2.0		Co-elutes with CBC #33 (See Table A2-5)							
22	2,3,4'-Trichlorobiphenyl	2.0	Y	385	47.8	12.4	311	443	8	192	577
23	2,3,5-Trichlorobiphenyl	2.0		Not Detected							
24	2,3,6-Trichlorobiphenyl	2.0		Not Detected							
25	2,3',4-Trichlorobiphenyl	2.0		245	34.8	14.2	188	300	8	122	367
26	2,3',5-Trichlorobiphenyl	2.0		Co-elutes with CBC #29 (See Table A2-5)							
27	2,3',6-Trichlorobiphenyl	2.0		81	6.5	8.1	72.1	94.3	8	40	121

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
28	2,4,4'-Trichlorobiphenyl	2.0	Y	Co-elutes with CBC #20 (See Table A2-5)							
29	2,4,5-Trichlorobiphenyl	2.0		Co-elutes with CBC #26 (See Table A2-5)							
30	2,4,6-Trichlorobiphenyl	2.0		Co-elutes with CBC #18 (See Table A2-5)							
31	2,4',5-Trichlorobiphenyl	2.0	Y	1132	113.8	10.1	980	1300	8	566	1697
32	2,4',6-Trichlorobiphenyl	2.0	Y	237	30.9	13.1	194	274	8	118	355
33	2,3',4'-Trichlorobiphenyl	2.0	Y	Co-elutes with CBC #21 (See Table A2-5)							
34	2,3',5'-Trichlorobiphenyl	2.0		Not Detected							
35	3,3',4-Trichlorobiphenyl	2.0		26	4.3	16.6	20.6	32.5	8	13	39
36	3,3',5-Trichlorobiphenyl	2.0		Not Detected							
37	3,4,4'-Trichlorobiphenyl	2.0	Y	355	44.7	12.6	299	421	8	178	533
38	3,4,5-Trichlorobiphenyl	2.0		Not Detected							
39	3,4',5-Trichlorobiphenyl	2.0		Not Detected							
40	2,2',3,3'-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #41/71 (See Table A2-5)							
41	2,2',3,4-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #40/71 (See Table A2-5)							
42	2,2',3,4'-Tetrachlorobiphenyl	2.0	Y	413	55.9	13.5	341	496	7	206	619
43	2,2',3,5-Tetrachlorobiphenyl	2.0		Not Detected							
44	2,2',3,5'-Tetrachlorobiphenyl	2.0	Y	Co-elutes with CBC #47/65 (See Table A2-5)							
45	2,2',3,6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #51 (See Table A2-5)							
46	2,2',3,6'-Tetrachlorobiphenyl	2.0		75	11.8	15.7	56.6	91.2	8	37	112
47	2,2',4,4'-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #44/65 (See Table A2-5)							
48	2,2',4,5-Tetrachlorobiphenyl	2.0		246	44.4	18.1	178	316	7	123	369
49	2,2',4,5'-Tetrachlorobiphenyl	2.0	Y	Co-elutes with CBC #69 (See Table A2-5)							
50	2,2',4,6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #53 (See Table A2-5)							
51	2,2',4,6'-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #45 (See Table A2-5)							
52	2,2',5,5'-Tetrachlorobiphenyl	2.0	Y	3743	447.6	12.0	3020	4300	8	1871	5614
53	2,2',5,6'-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #50 (See Table A2-5)							
54	2,2',6,6'-Tetrachlorobiphenyl	2.0		Not Detected							
55	2,3,3',4-Tetrachlorobiphenyl	2.0		Not Detected							

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
56	2,3,3',4'-Tetrachlorobiphenyl	2.0	Y	651	139.8	21.5	462	902	8	326	977
57	2,3,3',5-Tetrachlorobiphenyl	2.0		Not Detected							
58	2,3,3',5'-Tetrachlorobiphenyl	2.0		Not Detected							
59	2,3,3',6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #62/75 (See Table A2-5)							
60	2,3,4,4'-Tetrachlorobiphenyl	2.0	Y	253	124.4	49.3	206	435	8	126	379
61	2,3,4,5-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #70/74/76 (See Table A2-5)							
62	2,3,4,6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #59/75 (See Table A2-5)							
63	2,3,4',5-Tetrachlorobiphenyl	2.0		59	11.4	19.2	48.0	81.6	8	30	89
64	2,3,4',6-Tetrachlorobiphenyl	2.0	Y	659	81.3	12.3	550	804	8	329	988
65	2,3,5,6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #44/47 (See Table A2-5)							
66	2,3',4,4'-Tetrachlorobiphenyl	2.0	Y	1654	301.0	18.2	1310	2270	8	827	2481
67	2,3',4,5-Tetrachlorobiphenyl	2.0		56	10.2	18.1	43.0	74.0	7	28	84
68	2,3',4,5'-Tetrachlorobiphenyl	2.0		22	4.9	21.7	17.8	32.0	7	11	34
69	2,3',4,6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #49 (See Table A2-5)							
70	2,3',4',5-Tetrachlorobiphenyl	2.0	Y	Co-elutes with CBC #61/74/76 (See Table A2-5)							
71	2,3',4',6-Tetrachlorobiphenyl	2.0	Y	Co-elutes with CBC #40/41 (See Table A2-5)							
72	2,3',5,5'-Tetrachlorobiphenyl	2.0		37	7.5	20.3	29.1	51.1	7	19	56
73	2,3',5',6-Tetrachlorobiphenyl	2.0		Not Detected							
74	2,4,4',5-Tetrachlorobiphenyl	2.0	Y	Co-elutes with CBC #61/70/76 (See Table A2-5)							
75	2,4,4',6-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #59/62 (See Table A2-5)							
76	2,3',4',5'-Tetrachlorobiphenyl	2.0		Co-elutes with CBC #61/70/74 (See Table A2-5)							
77	3,3',4,4'-Tetrachlorobiphenyl	2.0		135	19.3	14.3	113	161	8	68	203
78	3,3',4,5-Tetrachlorobiphenyl	2.0		Not Detected							
79	3,3',4,5'-Tetrachlorobiphenyl	2.0		Not Detected							
80	3,3',5,5'-Tetrachlorobiphenyl	2.0		Not Detected							
81	3,4,4',5-Tetrachlorobiphenyl	2.0		Not Detected							
82	2,2',3,3',4-Pentachlorobiphenyl	2.0		486	33.3	6.9	446	540	8	243	729
83	2,2',3,3',5-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #99 (See Table A2-5)							

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
84	2,2',3,3',6-Pentachlorobiphenyl	2.0	Y	1327	31.5	2.4	1280	1370	7	664	1991
85	2,2',3,4,4'-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #116/117 (See Table A2-5)							
86	2,2',3,4,5-Pentachlorobiphenyl	2.0		Co-elutes with CBC #87/97/108/119/125 (See Table A2-5)							
87	2,2',3,4,5'-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #86/97/108/119/125 (See Table A2-5)							
88	2,2',3,4,6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #91 (See Table A2-5)							
89	2,2',3,4,6'-Pentachlorobiphenyl	2.0		Not Detected							
90	2,2',3,4',5-Pentachlorobiphenyl	2.0		Co-elutes with CBC #101/113 (See Table A2-5)							
91	2,2',3,4',6-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #88 (See Table A2-5)							
92	2,2',3,5,5'-Pentachlorobiphenyl	2.0	Y	1180	72.1	6.1	1060	1300	7	590	1770
93	2,2',3,5,6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #95/98/100/102 (See Table A2-5)							
94	2,2',3,5,6'-Pentachlorobiphenyl	2.0		20	1.6	7.9	17.7	21.8	6	10	30
95	2,2',3,5',6-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #93/98/100/102 (See Table A2-5)							
96	2,2',3,6,6'-Pentachlorobiphenyl	2.0		29	2.0	6.8	26.6	32.4	7	14	43
97	2,2',3,4',5'-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #86/87/108/119/125 (See Table A2-5)							
98	2,2',3,4',6'-Pentachlorobiphenyl	2.0		Co-elutes with CBC #93/95/100/102 (See Table A2-5)							
99	2,2',4,4',5-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #83 (See Table A2-5)							
100	2,2',4,4',6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #93/95/98/102 (See Table A2-5)							
101	2,2',4,5,5'-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #90/113 (See Table A2-5)							
102	2,2',4,5,6'-Pentachlorobiphenyl	2.0		Co-elutes with CBC #93/95/98/100 (See Table A2-5)							
103	2,2',4,5',6-Pentachlorobiphenyl	2.0		57	3.5	6.2	52.7	63.5	8	28	85
104	2,2',4,6,6'-Pentachlorobiphenyl	2.0		Not Detected							
105	2,3,3',4,4'-Pentachlorobiphenyl	2.0	Y	1371	116.1	8.5	1230	1540	7	686	2057
106	2,3,3',4,5-Pentachlorobiphenyl	2.0		Not Detected							
107	2,3,3',4',5-Pentachlorobiphenyl	2.0		Co-elutes with CBC #124 (See Table A2-5)							
108	2,3,3',4,5'-Pentachlorobiphenyl	2.0		Co-elutes with CBC #86/87/97/119/125 (See Table A2-5)							
109	2,3,3',4,6-Pentachlorobiphenyl	2.0	Y	Not Detected							
110	2,3,3',4',6-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #115 (See Table A2-5)							
111	2,3,3',5,5'-Pentachlorobiphenyl	2.0		Not Detected							

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
112	2,3,3',5,6-Pentachlorobiphenyl	2.0		Not Detected							
113	2,3,3',5',6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #90/101 (See Table A2-5)							
114	2,3,4,4',5-Pentachlorobiphenyl	2.0		68	8.2	12.0	57.0	78.0	7	34	102
115	2,3,4,4',6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #110 (See Table A2-5)							
116	2,3,4,5,6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #85/117 (See Table A2-5)							
117	2,3,4',5,6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #85/116 (See Table A2-5)							
118	2,3',4,4',5-Pentachlorobiphenyl	2.0	Y	4021	764.9	19.0	3350	5710	8	2011	6032
119	2,3',4,4',6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #86/87/97/108/125 (See Table A2-5)							
120	2,3',4,5,5'-Pentachlorobiphenyl	2.0		19	2.3	12.2	15.1	20.6	7	9.3	28
121	2,3',4,5',6-Pentachlorobiphenyl	2.0		Not Detected							
122	2,3,3',4',5'-Pentachlorobiphenyl	2.0		44	10.0	22.6	30.0	56.3	7	22	66
123	2,3',4,4',5'-Pentachlorobiphenyl	2.0		54	6.1	11.4	45.0	62.6	7	27	81
124	2,3',4',5,5'-Pentachlorobiphenyl	2.0	Y	Co-elutes with CBC #107 (See Table A2-5)							
125	2,3',4',5',6-Pentachlorobiphenyl	2.0		Co-elutes with CBC #86/87/97/108/119 (See Table A2-5)							
126	3,3',4,4',5-Pentachlorobiphenyl	2.0		Not Detected							
127	3,3',4,5,5'-Pentachlorobiphenyl	2.0		Not Detected							
128	2,2',3,3',4,4'-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #166 (See Table A2-5)							
129	2,2',3,3',4,5-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #138/160/163 (See Table A2-5)							
130	2,2',3,3',4,5'-Hexachlorobiphenyl	2.0	Y	591	50.9	8.6	518	693	8	296	887
131	2,2',3,3',4,6-Hexachlorobiphenyl	2.0	Y	116	14.0	12.1	105	139	5	58	174
132	2,2',3,3',4,6'-Hexachlorobiphenyl	2.0	Y	4569	582.7	12.8	3880	5630	7	2284	6853
133	2,2',3,3',5,5'-Hexachlorobiphenyl	2.0	Y	179	15.8	8.8	157	199	7	90	269
134	2,2',3,3',5,6-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #143 (See Table A2-5)							
135	2,2',3,3',5,6'-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #151/154 (See Table A2-5)							
136	2,2',3,3',6,6'-Hexachlorobiphenyl	2.0	Y	2141	280.2	13.1	1670	2570	7	1071	3212
137	2,2',3,4,4',5-Hexachlorobiphenyl	2.0	Y	223	29.6	13.3	189	272	7	112	335
138	2,2',3,4,4',5'-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #129/160/163 (See Table A2-5)							
139	2,2',3,4,4',6-Hexachlorobiphenyl	2.0		Co-elutes with CBC #140 (See Table A2-5)							

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
140	2,2',3,4,4',6'-Hexachlorobiphenyl	2.0		Co-elutes with CBC #139 (See Table A2-5)							
141	2,2',3,4,5,5'-Hexachlorobiphenyl	2.0	Y	3657	395.7	10.8	3090	4200	7	1829	5486
142	2,2',3,4,5,6-Hexachlorobiphenyl	2.0		Not Detected							
143	2,2',3,4,5,6'-Hexachlorobiphenyl	2.0		Co-elutes with CBC #134 (See Table A2-5)							
144	2,2',3,4,5',6-Hexachlorobiphenyl	2.0	Y	862	57.7	6.7	781	945	7	431	1293
145	2,2',3,4,6,6'-Hexachlorobiphenyl	2.0		Not Detected							
146	2,2',3,4',5,5'-Hexachlorobiphenyl	2.0	Y	2029	303.2	14.9	1640	2410	7	1014	3043
147	2,2',3,4',5,6-Hexachlorobiphenyl	2.0		Co-elutes with CBC #149 (See Table A2-5)							
148	2,2',3,4',5,6'-Hexachlorobiphenyl	2.0		Not Detected							
149	2,2',3,4',5',6-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #147 (See Table A2-5)							
150	2,2',3,4',6,6'-Hexachlorobiphenyl	2.0		Not Detected							
151	2,2',3,5,5',6-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #135/154 (See Table A2-5)							
152	2,2',3,5,6,6'-Hexachlorobiphenyl	2.0		Not Detected							
153	2,2',4,4',5,5'-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #168 (See Table A2-5)							
154	2,2',4,4',5,6'-Hexachlorobiphenyl	2.0		Co-elutes with CBC #135/151 (See Table A2-5)							
155	2,2',4,4',6,6'-Hexachlorobiphenyl	2.0		Not Detected							
156	2,3,3',4,4',5-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #157 (See Table A2-5)							
157	2,3,3',4,4',5'-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #156 (See Table A2-5)							
158	2,3,3',4,4',6-Hexachlorobiphenyl	2.0	Y	1257	132.4	10.5	998	1430	7	628	1885
159	2,3,3',4,5,5'-Hexachlorobiphenyl	2.0		239	81.5	34.1	143	385	6	119	358
160	2,3,3',4,5,6-Hexachlorobiphenyl	2.0		Co-elutes with CBC #129/138/163 (See Table A2-5)							
161	2,3,3',4,5',6-Hexachlorobiphenyl	2.0		Not Detected							
162	2,3,3',4',5,5'-Hexachlorobiphenyl	2.0		Not Detected							
163	2,3,3',4',5,6-Hexachlorobiphenyl	2.0	Y	Co-elutes with CBC #129/138/160 (See Table A2-5)							
164	2,3,3',4',5',6-Hexachlorobiphenyl	2.0	Y	1068	118.1	11.1	866	1200	7	534	1602
165	2,3,3',5,5',6-Hexachlorobiphenyl	2.0		Not Detected							
166	2,3,4,4',5,6-Hexachlorobiphenyl	2.0		Co-elutes with CBC #128 (See Table A2-5)							
167	2,3',4,4',5,5'-Hexachlorobiphenyl	2.0	Y	367	14.4	3.9	348	385	7	184	551

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
168	2,3',4,4',5',6-Hexachlorobiphenyl	2.0		Co-elutes with CBC #153 (See Table A2-5)							
169	3,3',4,4',5,5'-Hexachlorobiphenyl	2.0		Not Detected							
170	2,2',3,3',4,4',5-Heptachlorobiphenyl	2.0	Y	5251	715.7	13.6	4040	6100	8	2626	7877
171	2,2',3,3',4,4',6-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #173 (See Table A2-5)							
172	2,2',3,3',4,5,5'-Heptachlorobiphenyl	2.0	Y	903	206.0	22.8	632	1220	8	452	1355
173	2,2',3,3',4,5,6-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #171 (See Table A2-5)							
174	2,2',3,3',4,5,6'-Heptachlorobiphenyl	2.0	Y	6604	1100.6	16.7	4670	8300	8	3302	9906
175	2,2',3,3',4,5',6-Heptachlorobiphenyl	2.0	Y	249	29.0	11.6	202	283	8	125	374
176	2,2',3,3',4,6,6'-Heptachlorobiphenyl	2.0	Y	806	95.6	11.9	672	979	8	403	1209
177	2,2',3,3',4,5',6'-Heptachlorobiphenyl	2.0	Y	3630	471.6	13.0	2980	4320	8	1815	5445
178	2,2',3,3',5,5',6-Heptachlorobiphenyl	2.0	Y	1237	194.2	15.7	859	1500	8	619	1856
179	2,2',3,3',5,6,6'-Heptachlorobiphenyl	2.0	Y	2719	293.5	10.8	2250	3100	8	1359	4078
180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #193 (See Table A2-5)							
181	2,2',3,4,4',5,6-Heptachlorobiphenyl	2.0	Y	Not Detected							
182	2,2',3,4,4',5,6'-Heptachlorobiphenyl	2.0		Not Detected							
183	2,2',3,4,4',5',6-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #185 (See Table A2-5)							
184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	2.0		Not Detected							
185	2,2',3,4,5,5',6-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #183 (See Table A2-5)							
186	2,2',3,4,5,6,6'-Heptachlorobiphenyl	2.0		Not Detected							
187	2,2',3,4',5,5',6-Heptachlorobiphenyl	2.0	Y	7316	1289.5	17.6	5430	9090	8	3658	10974
188	2,2',3,4',5,6,6'-Heptachlorobiphenyl	2.0		Not Detected							
189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	2.0	Y	185	11.1	6.0	168	198	8	93	278
190	2,3,3',4,4',5,6-Heptachlorobiphenyl	2.0	Y	1077	200.7	18.6	803	1470	8	539	1616
191	2,3,3',4,4',5',6-Heptachlorobiphenyl	2.0	Y	217	40.6	18.8	163	270	8	108	325
192	2,3,3',4,5,5',6-Heptachlorobiphenyl	2.0		Not Detected							
193	2,3,3',4',5,5',6-Heptachlorobiphenyl	2.0	Y	Co-elutes with CBC #180 (See Table A2-5)							
194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	2.0	Y	2624	391.8	14.9	2160	3390	8	1312	3936
195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	2.0	Y	1169	163.2	14.0	989	1400	8	585	1754

Table A2-4: Composite Laboratory Results and Advisory Control Limits
Chlorinated Biphenyl Congeners (CBC)

No.	CBC Target Analyte	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
196	2,2',3,3',4,4',5,6'-Octachlorobiphenyl	2.0	Y	1579	183.8	11.6	1290	1780	7	789	2368
197	2,2',3,3',4,4',6,6'-Octachlorobiphenyl	2.0	Y	Co-elutes with CBC #200 (See Table A2-5)							
198	2,2',3,3',4,5,5',6-Octachlorobiphenyl	2.0	Y	Co-elutes with CBC #199 (See Table A2-5)							
199	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	2.0	Y	Co-elutes with CBC #198 (See Table A2-5)							
200	2,2',3,3',4,5,6,6'-Octachlorobiphenyl	2.0	Y	Co-elutes with CBC #197 (See Table A2-5)							
201	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	2.0	Y	373	65.6	17.6	273	480	7	187	560
202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	2.0	Y	487	51.9	10.7	427	590	8	243	730
203	2,2',3,4,4',5,5',6-Octachlorobiphenyl	2.0	Y	1829	354.3	19.4	1350	2300	8	914	2743
204	2,2',3,4,4',5,6,6'-Octachlorobiphenyl	2.0		Not Detected							
205	2,3,3',4,4',5,5',6-Octachlorobiphenyl	2.0	Y	143	9.2	6.5	129	160	8	71	214
206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	2.0	Y	575	39.2	6.8	527	633	7	288	863
207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	2.0	Y	91	18.6	20.4	76.4	130	7	46	137
208	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl	2.0	Y	124	7.5	6.1	115	136	7	62	186
209	Decachlorobiphenyl	2.0		97	4.4	4.6	90.6	102	6	48	145

Table A2-5: Composite Laboratory Results and Advisory Control Limits
Co-Eluting Chlorinated Biphenyl Congeners (CBC)

No.	Co-eluting CBC Target Analytes	QL ng/Kg	AR1260 CBC	Avg ng/Kg	SD ng/Kg	RSD	Min ng/Kg	Max ng/Kg	n	Advisory Control Limits (ng/Kg)	
										Low	High
12	3,4-Dichlorobiphenyl	-----		70	9.3	13.2	53.6	82.9	8	35	105
13	3,4'-Dichlorobiphenyl	-----									
18	2,2',5-Trichlorobiphenyl	-----	Y	615	78.3	12.7	493	701	8	307	922
30	2,4,6-Trichlorobiphenyl	-----									
20	2,3,3'-Trichlorobiphenyl	-----		1436	149.8	10.4	1210	1660	8	718	2154
28	2,4,4'-Trichlorobiphenyl	-----	Y								
21	2,3,4-Trichlorobiphenyl	-----		545	49.8	9.1	471	617	8	273	818
33	2,3',4'-Trichlorobiphenyl	-----	Y								
26	2,3',5-Trichlorobiphenyl	-----		506	47.9	9.5	409	561	8	253	759
29	2,4,5-Trichlorobiphenyl	-----									
40	2,2',3,3'-Tetrachlorobiphenyl	-----		717	125.8	17.5	561	968	8	359	1076
41	2,2',3,4-Tetrachlorobiphenyl	-----									
71	2,3',4',6-Tetrachlorobiphenyl	-----	Y								
44	2,2',3,5'-Tetrachlorobiphenyl	-----	Y	2026	194.2	9.6	1780	2340	7	1013	3039
47	2,2',4,4'-Tetrachlorobiphenyl	-----									
65	2,3,5,6-Tetrachlorobiphenyl	-----									
45	2,2',3,6-Tetrachlorobiphenyl	-----		224	37.0	16.5	175	276	8	112	336
51	2,2',4,6'-Tetrachlorobiphenyl	-----									
49	2,2',4,5'-Tetrachlorobiphenyl	-----	Y	1550	185.4	12.0	1300	1830	7	775	2325
69	2,3',4,6-Tetrachlorobiphenyl	-----									

Table A2-5: Composite Laboratory Results and Advisory Control Limits
Co-Eluting Chlorinated Biphenyl Congeners (CBC)

No.	Co-eluting CBC Target Analytes	QL ng/Kg	AR1260 CBC	Avg ng/Kg	SD ng/Kg	RSD	Min ng/Kg	Max ng/Kg	n	Advisory Control Limits (ng/Kg)	
										Low	High
50	2,2',4,6-Tetrachlorobiphenyl	-----		242	35.5	14.6	190	296	8	121	363
53	2,2',5,6'-Tetrachlorobiphenyl	-----									
59	2,3,3',6-Tetrachlorobiphenyl	-----		142	22.5	15.9	110	179	7	71	213
62	2,3,4,6-Tetrachlorobiphenyl	-----									
75	2,4,4',6-Tetrachlorobiphenyl	-----									
61	2,3,4,5-Tetrachlorobiphenyl	-----		3251	513.3	15.8	2550	4280	8	1626	4877
70	2,3',4',5-Tetrachlorobiphenyl	-----	Y								
74	2,4,4',5-Tetrachlorobiphenyl	-----	Y								
76	2,3',4',5'-Tetrachlorobiphenyl	-----									
83	2,2',3,3',5-Pentachlorobiphenyl	-----	Y	2548	373.6	14.7	1983	3120	8	1274	3821
99	2,2',4,4',5-Pentachlorobiphenyl	-----	Y								
85	2,2',3,4,4'-Pentachlorobiphenyl	-----	Y	737	29.5	4.0	704	780	7	368	1105
116	2,3,4,5,6-Pentachlorobiphenyl	-----									
117	2,3,4',5,6-Pentachlorobiphenyl	-----									
86	2,2',3,4,5-Pentachlorobiphenyl	-----		3337	142.6	4.3	3180	3560	7	1668	5005
87	2,2',3,4,5'-Pentachlorobiphenyl	-----	Y								
97	2,2',3,4',5'-Pentachlorobiphenyl	-----	Y								
108	2,3,3',4,5'-Pentachlorobiphenyl	-----									
119	2,3',4,4',6-Pentachlorobiphenyl	-----									
125	2,3',4',5',6-Pentachlorobiphenyl	-----									

Table A2-5: Composite Laboratory Results and Advisory Control Limits
Co-Eluting Chlorinated Biphenyl Congeners (CBC)

No.	Co-eluting CBC Target Analytes	QL ng/Kg	AR1260 CBC	Avg ng/Kg	SD ng/Kg	RSD	Min ng/Kg	Max ng/Kg	n	Advisory Control Limits (ng/Kg) Low	Advisory Control Limits (ng/Kg) High
88	2,2',3,4,6-Pentachlorobiphenyl	-----		674	49.9	7.4	590	726	8	337	1011
91	2,2',3,4',6-Pentachlorobiphenyl	-----	Y								
90	2,2',3,4',5-Pentachlorobiphenyl	-----		6957	787.6	11.3	5510	7710	6	3478	10435
101	2,2',4,5,5'-Pentachlorobiphenyl	-----	Y								
113	2,3,3',5',6-Pentachlorobiphenyl	-----									
93	2,2',3,5,6-Pentachlorobiphenyl	-----		5608	516.7	9.2	5037	6600	8	2804	8412
95	2,2',3,5',6-Pentachlorobiphenyl	-----	Y								
98	2,2',3,4',6'-Pentachlorobiphenyl	-----									
100	2,2',4,4',6-Pentachlorobiphenyl	-----									
102	2,2',4,5,6'-Pentachlorobiphenyl	-----									
107	2,3,3',4',5-Pentachlorobiphenyl	-----		249	105.2	42.3	144	420	7	124	373
124	2,3',4',5,5'-Pentachlorobiphenyl	-----	Y								
110	2,3,3',4',6-Pentachlorobiphenyl	-----	Y	6488	384.7	5.9	6000	6930	6	3244	9733
115	2,3,4,4',6-Pentachlorobiphenyl	-----									
128	2,2',3,3',4,4'-Hexachlorobiphenyl	-----	Y	1354	167.1	12.3	1020	1610	8	677	2031
166	2,3,4,4',5,6-Hexachlorobiphenyl	-----									
129	2,2',3,3',4,5-Hexachlorobiphenyl	-----	Y	14189	1183.2	8.3	12700	16400	8	7094	21283
138	2,2',3,4,4',5'-Hexachlorobiphenyl	-----	Y								
160	2,3,3',4,5,6-Hexachlorobiphenyl	-----									
163	2,3,3',4',5,6-Hexachlorobiphenyl	-----	Y								

Table A2-5: Composite Laboratory Results and Advisory Control Limits
Co-Eluting Chlorinated Biphenyl Congeners (CBC)

No.	Co-eluting CBC Target Analytes	QL	AR1260	Avg	SD	RSD	Min	Max	n	Advisory Control Limits (ng/Kg)	
		ng/Kg	CBC	ng/Kg	ng/Kg		ng/Kg	ng/Kg		Low	High
134	2,2',3,3',5,6-Hexachlorobiphenyl	-----	Y	657	45.0	6.8	595	714	6	329	986
143	2,2',3,4,5,6'-Hexachlorobiphenyl	-----									
135	2,2',3,3',5,6'-Hexachlorobiphenyl	-----	Y	6326	374.1	5.9	5896	6710	6	3163	9488
151	2,2',3,5,5',6-Hexachlorobiphenyl	-----	Y								
154	2,2',4,4',5,6'-Hexachlorobiphenyl	-----									
139	2,2',3,4,4',6-Hexachlorobiphenyl	-----		115	18.7	16.3	95.0	152	7	58	173
140	2,2',3,4,4',6'-Hexachlorobiphenyl	-----									
147	2,2',3,4',5,6-Hexachlorobiphenyl	-----		14314	1582.6	11.1	12800	17000		7157	21471
149	2,2',3,4',5',6-Hexachlorobiphenyl	-----	Y								
153	2,2',4,4',5,5'-Hexachlorobiphenyl	-----	Y	13913	1343.2	9.7	11900	16200	8	6956	20869
168	2,3',4,4',5',6-Hexachlorobiphenyl	-----									
156	2,3,3',4,4',5-Hexachlorobiphenyl	-----	Y	891	52.1	5.8	834	990	7	446	1337
157	2,3,3',4,4',5'-Hexachlorobiphenyl	-----	Y								
171	2,2',3,3',4,4',6-Heptachlorobiphenyl	-----	Y	1794	202.8	11.3	1540	2110	8	897	2691
173	2,2',3,3',4,5,6-Heptachlorobiphenyl	-----	Y								
180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	-----	Y	12396	1530.7	12.3	9370	14600	8	6198	18594
193	2,3,3',4',5,5',6-Heptachlorobiphenyl	-----	Y								
183	2,2',3,4,4',5',6-Heptachlorobiphenyl	-----	Y	4184	665.7	15.9	3110	5400	8	2092	6277
185	2,2',3,4,5,5',6-Heptachlorobiphenyl	-----	Y								

Table A2-5: Composite Laboratory Results and Advisory Control Limits
Co-Eluting Chlorinated Biphenyl Congeners (CBC)

No.	Co-eluting CBC Target Analytes	QL ng/Kg	AR1260 CBC	Avg ng/Kg	SD ng/Kg	RSD	Min ng/Kg	Max ng/Kg	n	Advisory Control Limits (ng/Kg) Low	High
197	2,2',3,3',4,4',6,6'-Octachlorobiphenyl	-----	Y	496	106.0	21.4	332	713	8	248	744
200	2,2',3,3',4,5,6,6'-Octachlorobiphenyl	-----	Y								
198	2,2',3,3',4,5,5',6-Octachlorobiphenyl	-----	Y	3260	626.4	19.2	2570	4420	8	1630	4890
199	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	-----	Y								

Table A2-6: Toxic Equivalency (TEQ) Based on Composite Laboratory Results – WHO Toxic CB Congeners

CBC No.	WHO Toxic CB Congener	Avg. Conc. ng/Kg	TEF* Mammals	TEF Adj. Conc.** Mammals ng/Kg	TEF Fish	TEF Adj. Conc. Fish ng/Kg	TEF Birds	TEF Adj. Conc. Birds ng/Kg
77	3,3',4,4'-Tetrachlorobiphenyl	135	0.0001	0.0135	0.0001	0.0135	0.05	6.75
81	3,4,4',5-Tetrachlorobiphenyl	ND	0.0003	ND	0.0005	ND	0.1	ND
105	2,3,3',4,4'-Pentachlorobiphenyl	1371	0.00003	0.04113	0.000005	0.006855	0.0001	0.1371
114	2,3,4,4',5-Pentachlorobiphenyl	68	0.00003	0.00204	0.000005	0.00034	0.0001	0.0068
118	2,3',4,4',5-Pentachlorobiphenyl	4021	0.00003	0.12063	0.000005	0.020105	0.00001	0.04021
123	2,3',4,4',5'-Pentachlorobiphenyl	54	0.00003	0.00162	0.000005	0.00027	0.00001	0.00054
126	3,3',4,4',5-Pentachlorobiphenyl	ND	0.1	ND	0.005	ND	0.1	ND
156/157	2,3,3',4,4',5-Hexachlorobiphenyl 2,3,3',4,4',5'-Hexachlorobiphenyl	891	0.00003	0.02673	0.000005	0.004455	0.0001	0.0891
167	2,3',4,4',5,5'-Hexachlorobiphenyl	367	0.00003	0.01101	0.000005	0.001835	0.00001	0.00367
169	3,3',4,4',5,5'-Hexachlorobiphenyl	ND	0.03	ND	0.000005	ND	0.001	ND
189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	185	0.00003	0.00555	0.000005	0.000925	0.00001	0.00185
TEQ				0.22221		0.04829		7.02927

* TEF = Toxic Equivalency Factor from World Health Organization (WHO) (Mammal 2005, Fish and Bird 1998).
** TEF Adj. Conc. = Adjusted concentration of each congener based on the product of the detected concentration and the respective TEF.

APPENDIX 3

Technical Memorandum – Development and Production of the
Puget Sound Sediment Reference Material SR0431

PUGET SOUND SEDIMENT REFERENCE MATERIAL
QATS LABORATORY INSTRUCTIONS FOR
HRGC/HRMS CDD/CDF/CB CONGENER AND GC/ECD AROCLOR ANALYSIS

NOTE: These instructions are for advisory purposes only. If any apparent conflict exists between these instructions and the analytical protocols or your contract, disregard these instructions.

APPLICATION: For the analysis of CDD/CDF and CB Congener analytes using project-specified HRGC/HRMS methods, and Aroclors using project-specified GC/ECD methods.

CAUTION: Read instructions carefully before opening bottles and proceeding with the analyses.

This Sample Contains Chemicals Known or Suspected to Have Serious Human Health Effects.

Material Safety Data Sheets Available Upon Request

(A) *SAMPLE DESCRIPTION*

Enclosed is a Puget Sound (Washington State) Sediment Reference Material (SRM) set for chlorinated dibenzo-p-dioxins/chlorinated dibenzofurans (CDD/CDF), and/or chlorinated biphenyl (CB) congener analysis using project-specified high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS) methods. This SRM is also suitable for Aroclors analysis using project-specified gas chromatography/electron capture detection (GC/ECD) methods. This set consists of one (1) or more bottles, each with approximately 30 grams of Puget Sound SRM containing CDD/CDF, CB Congener, and/or Aroclor analytes. Check the chain-of-custody record to determine the number of bottles provided for CDD/CDF, CB Congener, and/or Aroclor analysis. None of the bottles are to be opened until SRM preparation/analysis is to occur.

CAUTION: The SRM could contain compounds that are light sensitive and should be protected from light during storage. Store the SRM at ≤ 6° C, preferably at < 0° C, until SRM preparation and analysis is to occur. Allow the bottle(s) to reach ambient temperature before opening.

(B) *BREAKAGE OR MISSING ITEMS*

Check the contents of the shipment carefully for any broken, leaking, or missing items. Refer to the enclosed chain-of-custody record. Report any problems to Mr. Keith Strout, CB&I Federal Services, LLC, at (702) 895-8722. If requested, return the chain-of-custody record with appropriate annotations and signatures to the address provided below.

QUALITY ASSURANCE TECHNICAL SUPPORT LABORATORY
CB&I Federal Services, LLC
2700 Chandler Ave - Building C
Las Vegas, NV 89120

(C) *ANALYSIS REQUIREMENTS*

The SRM is to be analyzed as described in the project-specified methods employed for the analysis of CDD/CDF and/or CB Congener analytes using HRGC/HRMS instrumentation and/or Aroclors using GC/ECD instrumentation. These instructions are for advisory purposes only. If any apparent conflict exists between these instructions and the project-specified methods, or your contract, disregard these instructions.

(D) *SAMPLE ANALYSIS*

General Instructions

The SRM contains CDD/CDF, CB Congener, and Aroclor analytes which are known or suspected to have severe health effects. Employing appropriate safety precautions, this SRM is to be handled, prepared, and analyzed exactly as you would process samples received from a known or suspected hazardous waste site. The SRM should be handled only by trained and experienced analysts in facilities expressly designed to handle such materials. When calculating the concentrations of analytes, use 0% as the soil moisture content.

Allow the bottle(s) to reach ambient temperature before opening and removing gravimetric amounts for sample preparation. To begin the extraction and analysis procedure, break the seal and open the bottle carefully. Weigh out the appropriate aliquot for extraction and analysis as prescribed in the project-specified methods (typically 10 grams for HRGC/HRMS methods and 30 grams for GC/ECD methods), or in accordance with your contract.

Proceed immediately with the extraction and analysis as described in the project-specified methods or your contract.

(E) *REPORTING*

Report the results for the prepared SRM as received.

Report the analytical results for the SRM to EPA or other appropriate Agency, using the format and other instructions for submission of data packages as specified in your contract.

PUGET SOUND SEDIMENT REFERENCE MATERIAL (SRM) REQUEST FORM

TO REQUEST PUGET SOUND SRM, PLEASE COMPLETE THIS FORM AND SEND IT TO:	
USEPA Region 10 SRM Manager Attn: Mr. Donald M. Brown 1200 Sixth Avenue, Suite 900 Seattle, WA 98101 **Phone:** (206) 553-0717 **Email:** brown.donaldm@epa.gov	**Special Instructions:**

NOTE: PUGET SOUND SEDIMENT REFERENCE MATERIAL IS USUALLY SHIPPED WITHIN 24 HOURS OF REQUEST.

Date of Request:		Project/Site Name:	
Date SRM Needed:		Project/Site Number:	
No. of Bottles Requested:		FedEx Account No.	

NOTE: PUGET SOUND SEDIMENT REFERENCE MATERIAL IS PACKAGED IN GLASS BOTTLES CONTAINING 30 GRAMS OF MATERIAL.

Ship SRM, SRM request form, and Chain-of-Custody form with sample numbers to:					
Contact Name:		Email:			
Laboratory Name:					
Address:					
City:		State:		Zip Code:	
Phone:		Fax No.:			
Send copies of the SRM request form and Chain-of-Custody form with sample numbers to:					
Contact Name:		Email:			
Company:					
Address:					
City:		State:		Zip Code:	
Phone:		Fax No.:			

For QATS Laboratory Use Only			
No. of Samples Shipped:		Shipped By:	
Shipping Date:		Airbill No.:	
COC No.:			

As an authorized agency requestor, I certify that the Puget Sound SRM requested is to be used for USEPA Region 10 approved activities only.

Print Name	Authorized Signature
Authorized Agency:	Phone No: