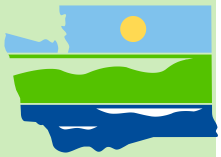

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PCB Method Comparison of High and Low Resolution Sediment Analysis

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PCB Method Comparison of High and Low Resolution Sediment Analysis

by

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Abstract

Traditionally, the sediment management community in Washington State has used Aroclor analysis when PCBs are compared to criteria. The Aroclor analysis is an older method with a number of limitations (e.g., detection limits above risk-based standards, signal changes from degradation and weathering, and a subjective approach to reading Aroclor patterns). Differences in toxicity of specific congeners led to the development of high resolution methods to provide congener-specific concentrations. However, these methods are expensive. A less rigorous intermediary method is needed to replace Aroclor analysis for screening level decisions.

Currently, there are three general types of EPA methods for analyses of PCBs in sediment: (1) congeners, high resolution, (2) homologs, low resolution, and (3) Aroclors. There is variation within these method types. This study compares all three, with emphasis on comparing homolog to congener methods.

A total of 10 archived marine and freshwater sediment samples from cleanup projects in Washington and Oregon with known PCB concentrations were split three ways and analyzed by congeners, homologs, and Aroclor methods. Detection limits varied between methods, with estimated sample detection limits for congeners averaging about 50 times lower than those reported for homologs and over 400 times lower than Aroclors.

A strong statistical relationship was noted for total PCBs determined by high resolution congener analysis (HRGC/HRMS) compared to either the low resolution homolog analysis (GC/LRMS) or the same dataset Kaplan and Meier adjusted to account for non-detects. When total PCB Aroclors were compared to high resolution congeners, a weaker, yet still strong, relationship was reported.

Analyzing additional congener and homolog split samples is recommended to augment study data and improve confidence in study results.

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Background

Polychlorinated biphenyls (PCBs) are stable toxic contaminants with the ability to bio-accumulate and biomagnify in the food chain. Because of their persistence, toxicity, and environmental ubiquity, PCBs are a major concern to resource managers. Included in a class of organic compounds called chlorinated hydrocarbons, PCBs are considered persistent organic pollutants (POPs).

One of the most often detected groups of toxic compounds, PCBs have been banned from manufacture in the United States since the 1970s. Persistence is generally thought to increase with increase in chlorination. Research has indicated some PCBs are likely carcinogens.

Washington State's regulatory community has traditionally used Aroclor methods for PCB analysis when comparisons are being made to sediment criteria. Recent updates to freshwater Sediment Management Standards[1] identified PCB Aroclor methods in new criteria for the protection of the benthic community. The recent update provides total PCB Aroclor criteria for freshwater-sediment-cleanup objectives and screening levels. Specific Aroclors are identified to sum for comparison to a total PCB criterion.

However, a number of issues are apparent in using the Aroclor method. Some of the method limitations include detection limits above risk-based sediment concentrations and sediment background concentrations, changes in the Aroclor analytical signal from degradation and weathering, and a subjective approach to reading Aroclor patterns.

Concern for the differences in congener-specific toxicity has led to the development of high resolution methods, to provide detail on the concentration of each congener. However, congener analysis is expensive[2]. A less rigorous intermediary analytical method is needed to replace Aroclor analysis for screening-level decisions.

Currently there are three general types of EPA methods available for analysis of PCBs in sediment. They include (1) congeners, (2) homologs, and (3) Aroclor methods:

- EPA 1668 - HRGC/HRMS (high resolution gas chromatography/high resolution mass spectrometry) is the high resolution PCB method, determining concentration of all 209 individual congeners, with some coelutes.
- EPA 8270D - GC/LRMS (gas chromatography/low resolution mass spectrometry), 8081 modified by EPA 625 (AXYS in-house method MLA 007), is lower resolution and less rigorous than PCB congener analysis. PCB homolog analysis is intermediary between high resolution and Aroclor methods, reporting the total concentration of homolog groups.
- SW-846 USEPA 8082A - GC/ECD (gas chromatography/electron capture detector) is a low resolution PCB method, reporting a concentration for each Aroclor.

[1] WAC 173-204-563(2)(m) and Table VI.
[2] HRGC/HRMS PCB congener analysis costs between $800 and $1200 per sample. LRMS PCB homolog analysis costs between $400 and $600 per sample. Aroclor analysis by EPA 8082 costs between $225 and $350 per sample.

PCB Use and Structure

PCBs are a group of man-made organic compounds with no known natural source. The manufacture of PCBs was ceased in July 1977 and were originally manufactured and sold as a good electric insulator, flame retardant and heat-transfer fluid, hydraulic fluid, lubricating oil, and as additives in paints, carbonless copy paper, adhesives, sealants, and plastics. Known commercially for advantages of stability and resistance to degradation under high temperature, these same properties contribute to their environmental persistence. The vast majority of PCB use was in capacitors and transformers. Currently there are no known manufacturers of PCBs anywhere in the world, except for synthesis of small amounts for research purposes (Erickson and Kaley, 2010).

A total of 209 individual PCB compounds called congeners exist as solids or in carrier oil-based liquid, without taste or smell. Each individual congener is assigned a name based on the number and location of chlorine atom attachment to two linked benzene rings (biphenyl). Congeners are divided into different groups, referred to as homologs or isomers based on the total number of chlorine atoms (1 to 10) attached to the biphenyl ring (Figure 1, fully chlorinated).

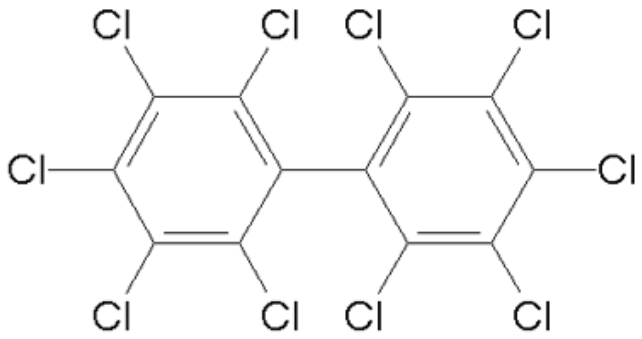

Figure 1. PCB Molecular Structure.

Goal and Objectives

The goal of the study was to determine if PCB homolog analysis provides needed information at a lower cost than high resolution congener analysis and lower detection limits than Aroclors. The objectives were to:

- Analyze 10 sediment samples as three-way splits for PCB congeners, homologs, and Aroclors.
- Compare PCB homolog totals to congener totals in homolog groups for correlations, and determine if strong relationships exist.
- Assess if PCB homolog analysis provides a higher level of precision and lower detection limits than Aroclors, as a screening-level method to replace Aroclor analysis for sediments.

Methods

Study Overview

The study was carried out by the Environmental Assessment Program of the Washington State Department of Ecology (Ecology). No sampling was conducted. Sediment used for analysis was provided by Ecology's Toxics Cleanup Program and the Shorelands and Environmental Assistance Program.

Archived marine and freshwater sediment samples from Washington and Oregon were selected from projects with generally known PCB concentrations ranging from 5 to 500 ug/Kg dry weight (dw), as determined using Aroclor methods. Included along with archive samples was one regional standard reference material (SRM) developed from Puget Sound sediment by EPA.

PCB congener and homolog analyses were conducted by AXYS Analytical Services, Sidney, British Columbia. Ecology's Manchester Environmental Laboratory (MEL) conducted the Aroclor analysis and contracted the laboratory for the congener and homolog analyses.

Currently, there are no Ecology-accredited laboratories to conduct GC/LRMS PCB homolog analysis. Homolog analysis has not been used as a regulatory method since before laboratory accreditation. This should not be an obstacle since the EPA has approved methods for homolog analyses, homolog methods have been used in the past, and method and standard operating procedure (SOP) development is a common activity for laboratories.

Sediment samples were homogenized and split three ways by AXYS Analytical Services, the contract laboratory conducting the congener and homolog analyses. One of each three-way split was repackaged and returned to MEL for Aroclor analysis. No ancillary analyses were requested.

Toxic cleanup evaluations of sediment have traditionally used PCB Aroclor methods for screening and sediment management. Study data provides information on the relationship between high resolution PCB congener analysis and PCB homolog analysis, such that either alone or with modifications to analytical procedures PCB homolog analysis could replace Aroclor analysis as a screening method.

PCB Analyses

PCB congener, homolog, and Aroclor methods used for the analysis of study samples are described below.

Congeners

PCB congener analysis by method EPA 1668 – HRGC/HRMS is the state-of-the-art high resolution method (EPA, 1999). Congener analysis would be the obvious choice over Aroclors if not for sample analysis costing twice as much or more than other methods. With detection limits

orders of magnitude lower than homolog or Aroclor analyses, EPA 1668 resolves all 209 individual congeners, including some coelutes, that have a wide range of toxicity. Congener analysis allows an accurate prediction of sample toxicity by resolving even those small proportions of the most toxic PCB congeners. PCB congener analysis allows a perspective into the risks associated with exposure. The World Health Organization (WHO, 2005) has developed toxic equivalency factors (TEFs) for the 12 most toxic PCB congeners (also known as "dioxin-like" or co-planar congeners) that can be compared to the toxicity of dioxin (2,3,7,8-TCDD). Method detection limits for sediment are in the sub-parts per trillion (ng/Kg, dw) range.

Homologs

PCB homolog analysis by method EPA 8270D GC/LRMS (EPA, 1994), 8081 modified by EPA 625 (AXYS in-house method MLA 007), is lower resolution and less rigorous than congener analysis. Homolog analysis holds promise for lower cost than high resolution analysis and can be applicable to sediment screening levels. Detection limits are lower than Aroclors and quality control is performed at a higher level. Homologs are groups of PCB congeners with equal numbers of chlorine-atom attachments in any arrangement to the biphenyl molecule. All congeners with the same number of chlorine atoms are in the same homolog group. For example, tetrachlorobiphenyls are PCB congeners all having four chlorine substitutes (Figure 1). There are 10 different PCB homolog groups possible from mono- through deca-chlorobiphenyls. This method reports a PCB total for each homolog group. In sediment, method detection limits are in the fractional parts-per-billion (ug/Kg, dw) range.

Aroclors

PCB Aroclor totals were determined by method SW-846 USEPA 8082A GC/ECD (EPA, 2008). Aroclor is a trade name for the commercial mixtures of PCBs made by the Monsanto Company. Each Aroclor is a mixture of PCB congeners, based on specific application needs. This method does not offer information for individual or the 12 "dioxin-like" congeners. Traditionally, Aroclors have been the regulatory choice in Washington State for PCB analysis of sediment because of the reasonable detection limits offered cost effectively, but they are not able to reach human health assessment levels that drive the cleanup standards.

PCB Aroclor concentrations are determined by matching gas chromatograph patterns (fingerprints) to a similar pattern indicative of known Aroclors. There are nine common Aroclor mixtures. Weathering and biotic degradation can be problematic by changing the Aroclor signal from its original shape. If too much sample degradation has occurred, Aroclor analysis can give erroneous results. Homolog or congener analysis is always a better choice for samples with high degradation potential. Method detection limits for Aroclor analyses are in the one to fractional parts per billion (ug/Kg, dw) range for sediments. The nine most common Aroclors are listed below.

- PCB-1016
- PCB-1221
- PCB-1232
- PCB-1242
- PCB-1248

- PCB-1254
- PCB-1260
- PCB-1262
- PCB-1268

Statistical Approach

To measure how well the PCB analytical methods agree, study results were statistically compared. As a measure of the degree of correlation between two analytical methods, r, the correlation coefficient, numerically describes the relationship. The r can range between -1 and +1. The closer the r to 1, the stronger the linear relationship is between two methods. An r of 1 would be a perfect positive correlation. The r value would be expected to be close to 1 when two methods in a comparison are precise.

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Results

In addition to the quality assessment, summary results are presented below. Tables A1 through A3 in Appendix A contain the complete PCB datasets of results for the three analytical methods.

A total of 10 sediment samples were homogenized and split three ways at the contract laboratory. For comparison, each one of the three sample splits was analyzed by a different PCB method. PCB analyses included methods EPA 1668 – HRGC/HRMS for high resolution congener analysis; EPA 8270D GC/LRMS, 8081 modified by EPA 625 for homolog analysis; and SW-846 EPA 8082A GC/ECD for Aroclors. AXYS Analytical analyzed the high resolution congeners and the low resolution homologs, while MEL conducted the Aroclor analysis.

When calculating PCB totals the "J" (estimated concentration, positively identified) and "NJ" (approximate concentration, tentatively identified) qualified results were included at full value for individual congener concentrations and PCB sample totals.

Comparisons of PCB congener results can be problematic because of the potential for "non-detected values". Some sediment management groups, like Ecology's Toxics Cleanup Program, apply Kaplan-Meier methods when calculating summed PCB congener totals as a way to deal with "nondetected" results. PCB analyses are good candidates for Kaplan-Meier methods because of the potential for "nondetects."

Two datasets were developed for the low resolution homolog analysis. One dataset excluded "nondetected" PCB values ("U" and "UJ") from totals, the other calculated by Kaplan and Meier (1958) methods included non-detected PCB values (see Table 2). Kaplan-Meier methods had no affect on the high resolution congener analysis, due to the low number of nondetected congeners.

For PCB Aroclors, standard summing method was used, since Aroclors are mixtures of PCB congeners that can overlap and application of the Kaplan-Meier approach is inappropriate. Only detected concentrations are summed, and when all Aroclors are nondetect, the compound is reported as nondetected at the highest detection limit.

The PCB study data set will not be included in Ecology's Environmental Information Management (EIM) database. These study samples were archives from other projects. Results for these samples are already reported elsewhere.

Quality Assessment

Results were reviewed for qualitative and quantitative accuracy following the National Functional Guidelines for Organic Data Review under the Contract Laboratory Program (CLP). Written case narratives assessing the quality of the data reports are provided by MEL. These narratives included descriptions of the analytical methods, a review of sample holding times, instrument calibration checks, blank results, surrogate recoveries, matrix spike recoveries, laboratory control samples, and laboratory duplicate analyses. The case narratives and complete data reports can be obtained from the report author by request.

The quality assurance (QA) review verified laboratory performance met most all quality control specifications outlined in the analytical methods. The quality of the data reported here is appropriate for the intended uses. To verify results generated for the study were of the quality needed, control sample results were compared to data quality objectives established in the QA Project Plan (Coots, 2012). Data quality results for the study are in the Appendix B, Tables B1 through B3. Specific quality issues noted in the case narratives are discussed below.

Sample Holding

All study samples were maintained and transferred to Ecology under chain of-custody from the time of collection. Study samples were sent by courier to MEL and arrived in coolers on ice within the proper holding temperature of < -10 ^{o}C. Preparation and analysis of all samples was completed within method holding-time limits.

Samples intended for analysis at the contract laboratory were preserved and stored under chain-of-custody procedures at MEL until shipped. Samples were repackaged and shipped by MEL to the contract laboratory conducting PCB congeners and homolog analyses.

Congeners

Laboratory staff found the container for frozen sample 1301022-07 was broken prior to analysis. The analyst determined that the integrity of the sample was not compromised, and it was transferred to a new container.

Any congener concentrations less than 10 times the concentration reported in the laboratory method blank were qualified as non-detected at the "estimated quantitation limit" (EQL)[3] or the "estimated detection limit" (EDL), whichever was higher. When congeners are detected in laboratory method blanks at less than 10% of the sample concentration, no qualification is applied. The method blank contamination is considered insignificant compared to the sample concentration.

No matrix spike/matrix spike duplicate analysis was performed for PCB congener analysis. However, an additional "laboratory control sample" (LCS) was prepared as mixtures of Aroclor 1242, 1254, and 1260. No limits have been established for this quality control (QC) sample. The percent recoveries ranged from 69% for Aroclor 1242, to 80% for Aroclor 1254, and to 92% for Aroclor 1260.

Sample 1301022-05 (FWA-03 and FWA-03DUP) was analyzed as a laboratory duplicate (Table B1). Some of the more highly chlorinated congeners were reported with relative percent differences (RPDs) greater than 40%. The average RPD for individual congeners from the laboratory duplicate pair was 23%. The analyst noted that because the more volatile congeners

[3] EQL is defined as the lowest validated non-zero standard in the calibration curve, adjusted for sample volume, weight and any dilutions. It is equivalent to the "Minimum Level" described in EPA method 1668. EDL is an estimate of the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the signal background level. The estimate is sample-specific and analyte-specific and may vary with sample size and dilution.

showed closer correlation than did the heavier congeners in both analyses the differences are most likely due not to deficiencies in laboratory procedures, but rather to heterogeneity of the sample.

Some congeners did not meet the isotopic-abundance ratio and retention-time criteria for positive identification. These congeners were qualified "NJ" (approximate concentration, tentatively identified).

In efforts to minimize matrix interferences, samples 1301022-05, 09, and 10 were diluted and re-analyzed. The affected target concentrations were reported from the diluted extracts.

An EPA regional standard reference material (SRM) for sediment (contract #EP-W-10-033) was included and treated as a study sample (Lab ID=1301022-01; Field ID=RM01). The EPA's total PCB target concentration reported for the SRM is 179 ug/Kg dw, with a ±50% acceptance range. The total PCB concentration reported from congener analysis of sample RM01 was 175 ug/Kg dw, an RPD of 2.3% compared to the total PCB concentration EPA reports for the regional SRM.

Table 1 presents homolog group totals based on the high resolution congener analysis reported in units of ug/Kg. The homolog totals below include detected compounds and estimated values (ie., "J" and "NJ"). Reported "nondetects" (i.e., "U" and "UJ") were not included in PCB totals. The complete dataset for PCB congeners analyzed by high resolution analysis is included in Appendix A, Table A1.

Table 1. PCB Homolog Group Totals by Congener Analysis Using High Resolution Gas Chromatography/High Resolution Mass Spectrometry, HRGC/HRMS (ug/Kg, dw).

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
Total Mono-CBs	0.0439	0.0413	0.00941	0.00666	0.0634	0.0804	0.0738	0.172	0.0505	0.0974
Total Di-CBs	1.01	1.14	0.177	0.139	1.93	1.23	2.1	0.659	0.716	1.66
Total Tri-CBs	5.71	3.58	1.33	0.366	15.4	5.84	10.9	3.45	1.43	2.6
Total Tetra-CBs	15.6	6.27	3.26	0.984	57.7	22.2	19	5.86	4.99	4.47
Total Penta-CBs	32.6	8.83	3.86	1.3	70.6	71.6	36.8	6.29	12.7	9.07
Total Hexa-CBs	62.8	4.32	4.71	1.54	73.1	57.6	26.4	4.52	10.2	7.47
Total Hepta-CBs	44.9	0.651	2.72	0.792	38.2	18.7	7.73	1.62	4.81	3.5
Total Octa-CBs	11	0.158	0.812	0.238	8.02	9.79	3.58	0.481	1.6	0.915
Total Nona-CBs	0.739	0.043	0.637	0.0704	0.732	4.57	1.7	0.0709	0.241	0.225
Total Deca-CBs	0.0992	0.0472	0.504	0.052	0.299	7.18	1.6	0.0604	0.148	0.257
Total PCBs	175	25.1	18.0	5.49	266	199	110	23.2	36.9	30.3

Homologs

Laboratory staff reported finding the frozen container for sample 1301022-07 broken prior to analysis. The analyst determined that the integrity of the sample was not compromised, and it was transferred to a new container.

No results were qualified based on laboratory method blank contamination. Only PCB-011 was detected in the method blank as a "tentatively identified" compound, "NJ." When compounds detected in method blanks are less than 10% of the sample concentration, no qualification is applied.

No matrix spike/matrix spike duplicate analysis was performed for homolog analyses. However, an additional LCS was prepared as mixtures of Aroclor 1242, 1254, and 1260. No limits have been established for this QC sample. The percent recoveries ranged from 104% for Aroclor 1242, to 113% for Aroclor 1254, and to 146% for Aroclor 1260.

Sample 1301022-03 (FWA-01 and FWA-01DUP) was split at the laboratory and analyzed as a laboratory duplicate (Appendix B, Table B2). One congener (PCB-01) was reported with an RPD greater than 40%. Individual congener RPDs for the duplicate pair averaged 11%. The total PCB concentration calculated from resolved congeners from the duplicate sample (17.5 ug/Kg, dw) showed good agreement with the PCB total from the parent sample (17.8 ug/Kg, dw; RPD = 1.7%).

The EPA SRM for sediment was analyzed as a study sample (Lab ID=1301022-01; Field ID=RM01). The SRM sample has a target total PCB concentration of 179 ug/Kg dw, with an acceptance range of $\pm$50%. The homolog analysis reported a total PCB concentration of 172 ug/Kg dw, an RPD of 4%.

Some congeners did not meet the isotopic-abundance ratio and retention-time criteria for positive identification. These congeners were qualified "NJ" (approximate concentration, tentatively identified).

Table 2 shows the PCB homolog group totals reported for each study sample along with the Kaplan-Meier adjustments to the homolog totals. Individual PCB congeners resolved by low resolution methods to determine homolog group totals are shown in Appendix A, Table A2.

Table 2. PCB Homolog Group Totals by EPA Method 8270D Using Gas Chromatography/ Low Resolution Mass Spectrometry, GC/LRMS (ug/Kg, dw).

Lab ID (1301022-) Field ID	01 RM -01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
Total Mono-CBs	0.498	*0.122 UJ*	*0.166 UJ*	*0.0903 UJ*	*0.324 UJ*	*0.0999 UJ*	*0.0451 UJ*	*0.133 UJ*	*0.172 UJ*	*0.282 UJ*
Total Di-CBs	0.983	1.24	0.267	0.197	2.34	1.02	1.77	0.525	0.907	2.59
Total Tri-CBs	6.3	3.55	2.18	0.222	17.2	6.6	11	1.77	1.65	4.1
Total Tetra-CBs	16.1	6.69	2.8	1	55.3	20.4	18.3	4.74	6.45	6.72
Total Penta-CBs	32.2	10.6	3.32	1.23	60.6	62.4	32.5	4.43	13.1	12
Total Hexa-CBs	62.1	4.67	3.83	1.5	43	50.9	23.7	3.78	10.8	10.2
Total Hepta-CBs	43	0.898	2.42	0.897	17.7	15.6	6.49	1.45	4.01	3.55
Total Octa-CBs	9.89	0.0888	0.54	0.293	4.31	8.26	3.01	0.158	*1.75*	0.714
Total Nona-CBs	0.815	*0.0895 UJ*	0.867	0.0961	0.773	6.06	1.8	*0.121 UJ*	*0.287 UJ*	*0.3*
Total Deca-CBs	0.106	0.18	0.707	0.13	0.556	6.18	1.65	0.104	0.21	0.481
Total PCBs	172	27.9	16.9	5.57	202	177	100	17	38.9	40.7
Kaplan-Meier PCBs	172	28	17	6	202	177	100	17	39	41

UJ = Highest estimated quantitation or detection limit (EQL or EDL) for individual congeners within a homolog group.

Aroclors

Laboratory staff found containers for frozen samples 1301022-04, 06, 08, and 09 broken prior to preparation for sample extraction. These samples were transferred to new clean containers.

The container for sample 1301022-10 was found broken just prior to the percent solids test. A loss of some liquid was reported. Due to the possible bias introduced from loss of sample prior to the percent solids test, Aroclor 1248 and 1254 were "J" qualified as estimates. Other sample Aroclors were qualified "UJ."

The two analytical columns for qualitative identification reported that, for two samples, RPDs were outside QC limits. Sample 1301022-03 was outside limits for Aroclor 1248 and 1260, while sample 1031022-05 for Aroclor 1254 and 1260. These Aroclors were "J" qualified as estimates.

As previously discussed, Aroclor patterns can degrade or weather over time, making it difficult to match to known reference mixtures. In cases where a good comparison to standards was not possible, when an Aroclor was verified as being present and has an RSD between analytical peaks exceeding 40%, the results are qualified as estimates ("J"). Aroclor 1254 and 1260 were "J" qualified in sample 1301022-05 and its laboratory duplicate, B13E167-DUP1.

Some Aroclors may have had high bias due to interference from another Aroclor. When interference is suggested between 20% and 50% results are qualified as estimates, "J." Samples 1301022-02, 05, 06, 07, and 10 were "J" qualified as estimates for Aroclor 1248. Additionally, samples 1301022-02, 05, 06, 07, and QC duplicate sample B13E167-DUP1 were "J" qualified for Aroclor 1260.

The regional SRM for sediment was also analyzed for Aroclors (Lab ID=1301022-01; Field ID=RM01). The SRM was developed using high resolution congener-analysis reporting values for individual and coeluting congeners. No QC limits have been established for Aroclor analysis, which are made from a subset of the 209 possible PCB congeners. Comparisons made to Aroclors are for informational purposes.

The target total PCB concentration from the regional SRM was 179 ug/Kg dw, with a ±50% acceptance range. Aroclor analysis reported a total PCBs concentration of 143 ug/Kg dw. The total PCB concentration for the RM01 sample and the target value for the SRM had an RPD of 22%, well within a ±50% acceptance range.

No PCB Aroclors were detected for samples 1301022-04 and 08. The highest Aroclor reporting limit for each sample was used as proxy in comparisons.

Table 3 shows the PCB Aroclor sample totals reported for each study sample. Kaplan-Meier adjustments are not applicable, as Aroclors are sums of overlapping congener groups.

Table 3. PCB Aroclor Totals Analyzed by EPA Method 8082 Using Gas Chromatography/ Electron Capture Detector, GC/ECD (ug/Kg, dw).

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-1016	16 U	9.0 U	6.3 U	7.3 U	11 UJ	15 UJ	25 UJ	9.2 U	16 U	8.8 UJ
PCB-1221	7.9 U	4.5 U	3.2 U	3.6 U	6.8 UJ	31 UJ	12 UJ	4.6 U	8.2 U	4.4 UJ
PCB-1232	16 U	9.0 U	6.3 U	7.3 U	6.8 U	31 UJ	25 UJ	9.2 U	16 UJ	8.8 UJ
PCB-1242	16 UJ	4.5 U	3.2 U	3.6 U	14 UJ	15 UJ	25 UJ	4.6 U	8.2 U	4.4 UJ
PCB-1248	26 UJ	4.5 U	**4.4 J**	3.6 U	**31 J**	**32 J**	**37 J**	4.6 U	8.2 U	**6.3 J**
PCB-1254	**53**	**6.2**	**6.4**	3.6 U	**46 J**	**51**	**45**	4.6 U	**12**	**7.9 J**
PCB-1260	**90**	4.5 U	**5.0 J**	3.6 U	**21 J**	**31 J**	**16 J**	4.6 U	8.2 U	4.4 UJ
PCB-1262	63 UJ	4.5 U	6.3 UJ	3.6 U	20 UJ	31 UJ	18 UJ	4.6 U	8.2 U	4.4 UJ
PCB-1268	7.9 U	4.5 U	3.2 U	3.6 U	3.4 U	15 UJ	6.1 UJ	4.6 U	8.2 U	4.4 UJ
Total PCB Aroclors	**143**	**6.2**	**16 J**	7.3 U[1]	**98 J**	**110 J**	**98 J**	9.2 U[1]	**12**	**14 J**

Bold = Visual aid for detected compounds.
U = Not detected at the reporting limit shown.
UJ = Not detected at the estimated reporting limit shown.
J = Analyte positively identified, result is an estimate.
1 = The highest Aroclor reporting limit for the sample.

Sample Detection Limits

For PCB analyses, limits of quantitation and detection are sample-specific. Table 4 summarizes sample mean estimated quantitation limits and detection limits for all three PCB methods in units of ng/Kg. For the congener analysis, each sample's highest detection limits came from hexa- followed by penta-homologs. Full quantitation and detection limit tables for the three PCB methods are in the Appendix B, Tables B4 through B6.

Table 4. Mean Sample Detection Limits for the Three PCB Methods (ng/Kg, dw).

	Congeners		Homologs		Aroclors[1]	
Sample ID 1301022-	Estimated Quantitation Limits[3]	Estimated Detection Limits[4]	Estimated Quantitation Limits[5]	Estimated Detection Limits[6]	Reporting Limits[7]	Method[2] Detection Limits[8]
01	0.410/0.448	4.54/5.11	390/441	99.5/133	9700/16000	1500/4600
02	0.396/0.433	0.603/0.767	187/211	67.1/104	5500/9000	870/2600
03	0.390/0.427	0.329/0.438	177/201	79.5/120	3900/6300	610/1800
04	0.407/0.444	0.206/0.274	193/218	40.2/62.0	4400/7300	700/2100
05	0.508/0.594	4.03/3.93	180/204	196/268	4200/6800	660/2000
06	0.383/0.419	4.88/7.46	175/198	185/246	4700/7700	740/2200
07	0.384/0.420	3.37/4.46	180/204	116/142	3800/6100	600/1800
08	0.407/0.449	0.918/1.18	183/207	119/178	5600/9200	900/2700
09	0.681/0.714	2.26/2.82	179/203	151/213	9900/16000	1600/4800
10	1.01/1.07	0.765/0.941	201/226	175/263	5400/8800	860/2600

1 = Values converted from ug/Kg to ng/Kg for table display.
2 = The minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero.
3 = Sample mean congener EQLs/highest congener EQL.
4 = Sample mean congener EDLs/highest congener EDL.
5 = Sample mean homolog group EQLs/highest homolog group EQLs.
6 = Sample mean homolog group EDLs/highest homolog group EDLs.
7 = Sample mean reporting limit/sample highest reporting limit.
8 = Sample mean method detection limit/sample highest method detection limit.

The laboratory reports high resolution congener and low resolution homolog analyses for sediment in units of ng/Kg, while Aroclors were reported in units of ug/Kg. To make comparisons easier, Aroclor results in Table 4 were converted from ug/Kg to ng/Kg.

Table 4 shows mean sample-estimated quantitation limits and detection limits for the three PCB methods. The laboratory provides congener-specific estimated quantitation and detection-limit values for the congener and homolog analyses. For Aroclor analyses, the laboratory provides a reporting limit and a method detection limit for each sample Aroclor.

Sample quantitation and detection limits were determined by two methods:

1. For each congener or homolog analysis, the mean of all sample congener estimated quantitation limits (EQLs) and estimated detection limits (EDLs) is shown in front of the slash in Table 4. For Aroclors this would be the mean reporting limit (RL) and method detection limit (MDL) for each sample.
2. The second approach is shown after the slash and is the mean of the highest EQL or EDL per homolog group for congeners or homologs and the highest sample RL and MDL for Aroclors, since the typical Ecology approach for summed chemicals when all components are nondetect is to report it as nondetected at the highest reporting limit for the group.

Detection limits varied for the three PCB analytical methods. Sample mean estimated detection limits for congeners averaged slightly more than 50 times lower than those reported for homolog analyses and about 400 times lower than Aroclors. Homologs sample average detection limits were about seven times lower than Aroclors.

At times the EDL in Table 4 is reported at a higher concentration than the EQL. This would seem to not make sense, but is caused by the use of different types of samples to generate the data and how they are calculated. The EDL is calculated as 2.5 times the sample average signal-to-noise ratio. When sample matrix interference pushes the signal-to-noise ratio upwards, the EDL is increased proportionally. The EQL is calculated from a clean matrix or ideal sample like a low level laboratory standard. When EQLs and EDLs were applied to sample data, the higher result of the two is used as a detection limit.

Discussion

The confidence and usefulness of a statistical comparison is related to the sample size. Normally the larger the sample size, the higher the level of confidence in the results. Drawing definitive conclusions based on 10 measurements is not advised. While not robust in the number of data points, this study does provide a good start for defining the strength of the relationship between high resolution PCB-congener analysis and lower-resolution analyses like PCB homologs or Aroclors.

Figure 2 shows total PCB results plotted from high resolution congener and low resolution homolog analyses. The two methods showed very good agreement (r = 0.988).

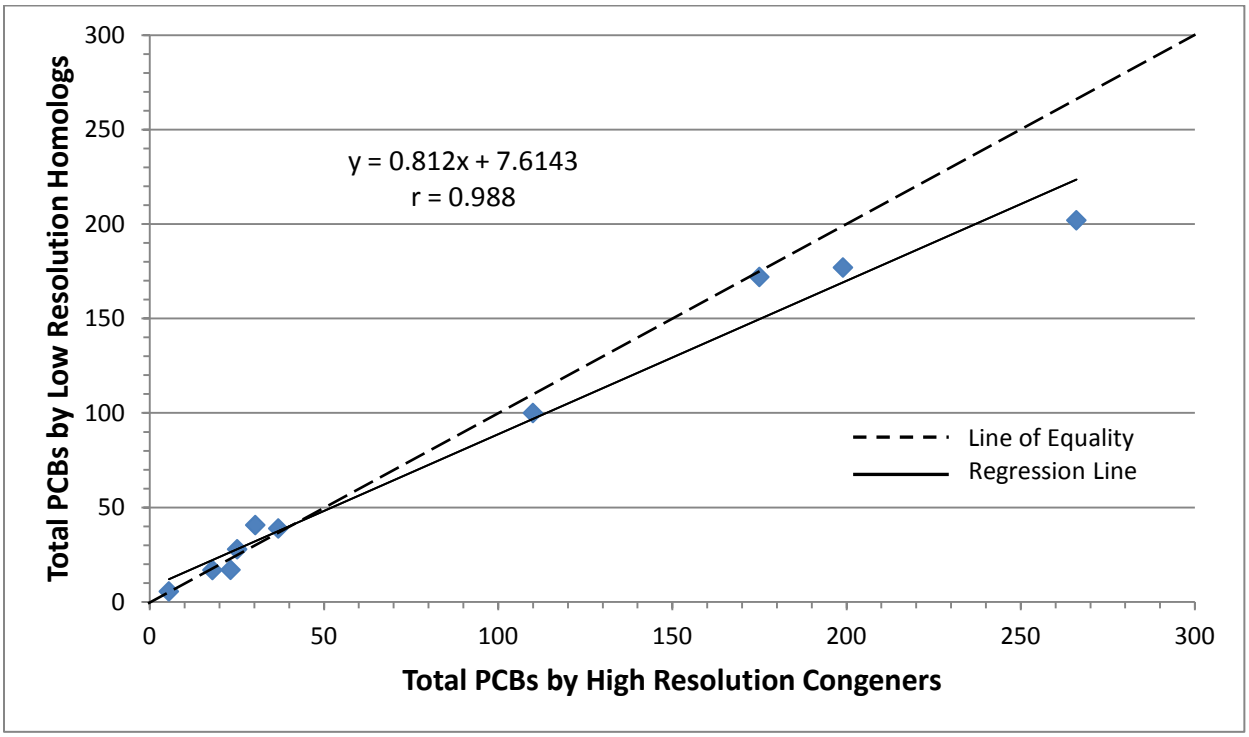

Figure 2. Total PCBs by High Resolution Congeners and Low Resolution Homolog Analyses.

The dashed line in Figure 2 is the line of equality, showing the location of a perfect 1-to-1 relationship for the two methods. If PCB sample concentrations for the two methods were equal the regression line and the line of equality would coincide. The low resolution homolog method appears to have a slight low bias at concentrations above 50 ug/Kg, compared to the high resolution congener method.

The high resolution congener analyses reported few non-detected congeners. Kaplan-Meier methods did not affect the high resolution results and were applied only to the homolog data to account for the much higher number of nondetects. Total PCB congener and Kaplan-Meier-adjusted homolog results were plotted below in Figure 3.

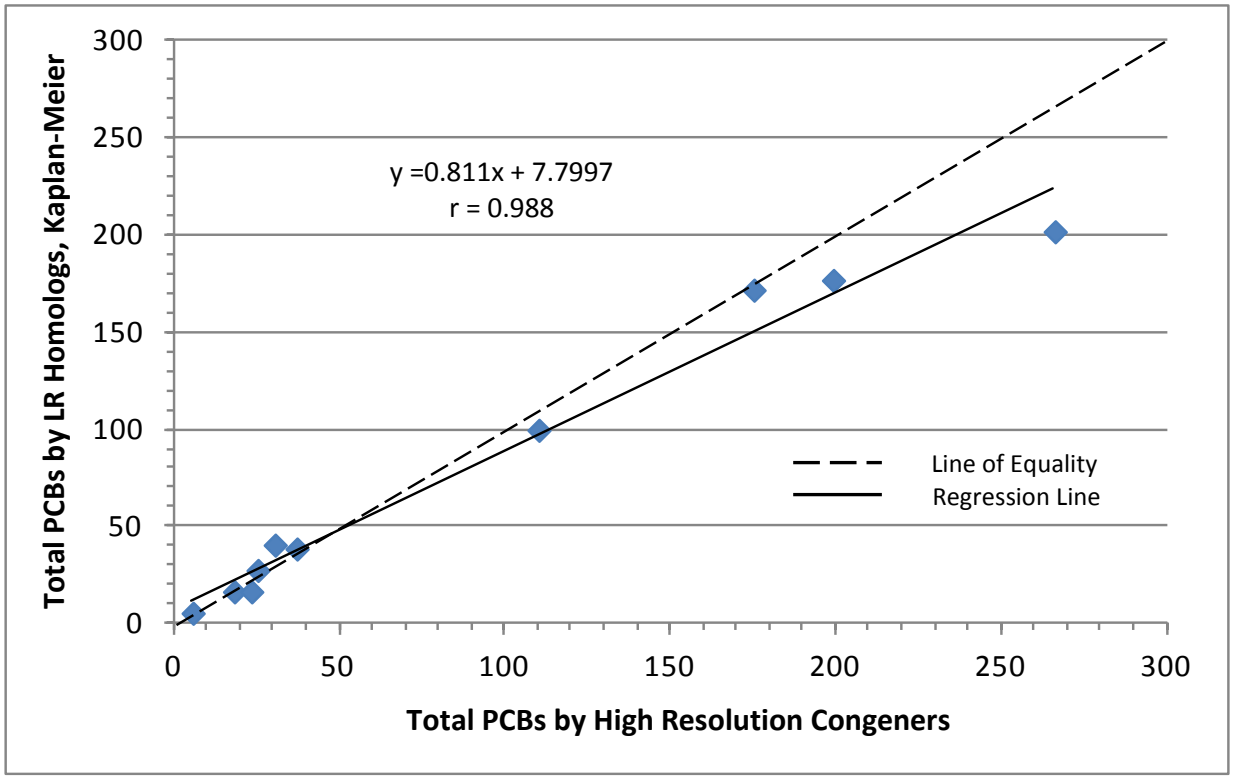

Figure 3. Total PCBs by High Resolution Congeners and Kaplan-Meier Adjusted Low Resolution Homolog Analyses.

Results are very similar to total PCB congeners compared to homolog results without Kaplan-Meier adjustment. The correlation coefficients were the same for both comparisons (r = 0.988), and only a small difference was noted in the regression equation accounting for slight concentration increases from the Kaplan-Meier adjustment. Kaplan-Meier methods slightly increased concentrations for five of the 10 samples ranging from 0.1 to 0.43 ug/Kg (Table 2).

Total PCB Aroclors compared to congeners showed a weaker relationship than homologs compared to congeners (Figure 4 and 2). Still, the lower r (0.879) indicates a strong relationship (Figure 4). Study data suggests Aroclor analysis may be biased low when compared to either congeners or homolog analyses. It should also be noted that two PCB samples, 1301022-04 and 08 were non-detects for PCB Aroclors, having all individual Aroclors reported below the MDL. The highest Aroclor reporting limit per sample was used as proxy in data comparisons.

When PCB Aroclors have been in the environment for a long time, weathering can cause underestimates due to degraded patterns. Overestimates can also occur when Aroclor analysis is used for low concentrations of PCBs or when Aroclors containing the same congeners are present, since these may be double counted. Individual Aroclors include congeners from three or four homolog groups.

Differences in total PCB concentrations measured by Aroclors compared to congeners or homologs reported RPDs averaging about 60%. In contrast, when total PCBs from congeners were compared to homolog methods RPDs averaged about 13%.

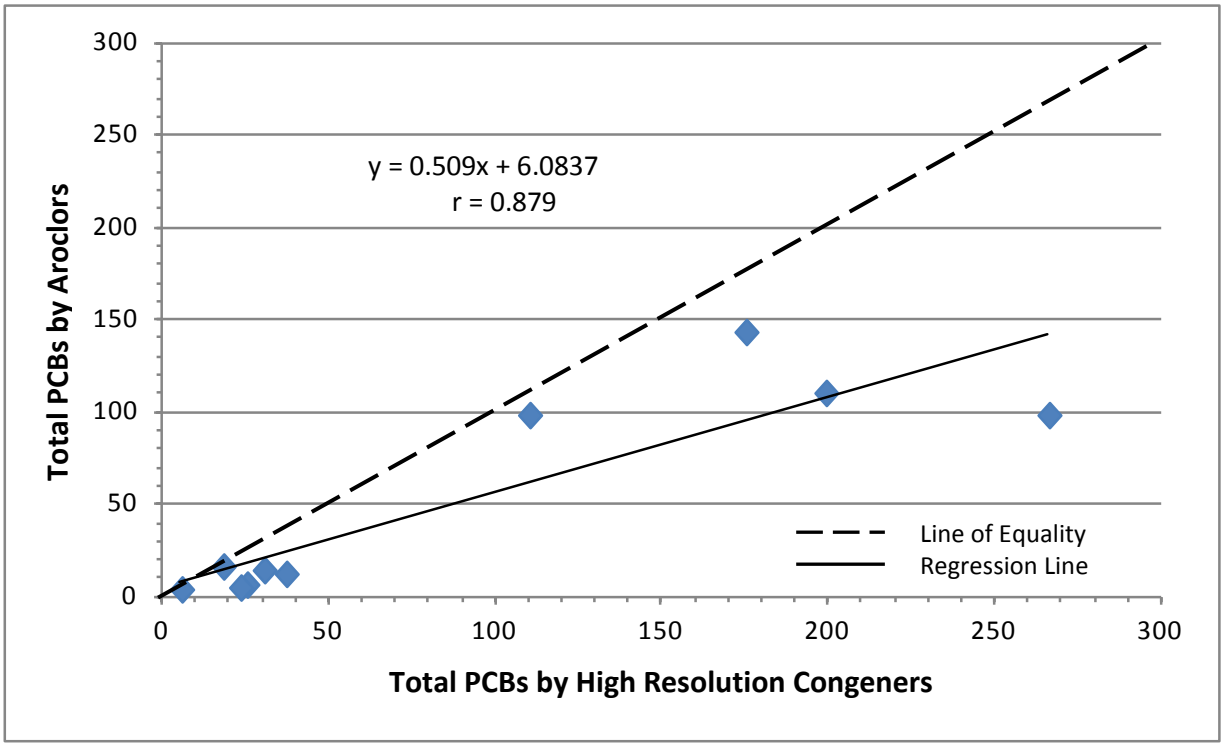

Figure 4. Total PCBs by High Resolution Congeners and Aroclor Analyses.

Other benefits may also be realized by choosing homolog analysis over Aroclors. In addition to the strength of relationship between the low resolution homolog and high resolution congener analyses, homologs may be able to identify through presence absence homolog groups containing the dioxin-like PCBs. All dioxin-like congeners are within the 4, 5, 6, or 7 chlorine-attachment groups (homologs). High PCB concentrations within these homolog groups may infer higher potential for dioxin-like congeners to be present. Further investigation may then proceed to include high resolution methods for specifics of the dioxin-like congeners.

Low resolution homolog analysis by MS methods is determined by resolution of congeners but has higher detection limits as compared to HRGC/HRMS methods. Thus, LRMS methods may also be able to do rough fingerprinting if critical fingerprinting congener concentrations are above detection limits for the samples. Additionally, PCB weathering is irrelevant to MS analysis, where it can complicate identification and quantification of Aroclors using ECD methods. Generally, if weathering is known to be an issue, Aroclor analyses should be avoided, and LRMS methods should be used. There is no single PCB method that can do everything, so application will still be a concern.

The low resolution GC/MS PCB homolog method is not currently accredited under Ecology's Laboratory Accreditation Program. A good first step to bring homolog analysis into use would be to request the MEL to conduct SOP and method development with the Laboratory Accreditation Program.

Table 5 below compares the three PCB analytical methods. Information is provided describing each analysis, the analytical method used, estimated costs per sample, reporting and detection limits, and the average percentage of non-detected results per method. The estimated mean quantitation and detection limits in Table 5 are sample averages of all congener EQLs and EDLs from the congener and homolog methods. Aroclor analysis does not resolve individual congeners so the percent nondetects would not apply. While both congener and homolog analysis detected PCBs in every sample, two of the 10 samples were nondetects for PCB Aroclor analysis.

Table 5. Comparison of PCB Sediment Analyses.

Analysis	Method	Estimated Cost/ Sample	Estimated Mean Quantitation Limit	Estimated Mean Detection Limit	Percent Non-Detects[8]
Congeners	HRGC/HRMS[1] 1668C	$800- 1200	0.498 ng/Kg[4]	2.19 ng/Kg[6]	10% (16/159)
Homologs	GC/LRMS[2] EPA Methods 8270D, 625, and 8081 A/B	$400-600	205 ng/Kg[4]	123 ng/Kg[6]	51% (82/160)
Aroclors	GC/ECD[3] SW-846, EPA 8082A	$225-350	5700 ng/Kg[5]	904 ng/Kg[7]	NA[9]

1 = High resolution gas chromatography/high resolution mass spectrometry.
2 = Gas chromatography/low resolution mass spectrometry.
3 = Gas chromatography/electron capture detector.
4 = The mean of sample estimated quantitation limits (EQL).
5 = The mean of sample reporting limits (RL).
6 = The mean of sample estimated detection limits (EDL).
7 = The mean of sample method detection limits (MDL).
8 = Per sample mean percent of non-detected congeners (nondetected/total possible x 100).
9 = “Not Applicable”, individual congeners not resolved by Aroclor analysis.

Conclusions

Results of this 2013 study support the following conclusions:

- Total PCB results from high resolution congener and low resolution homolog methods were highly correlated (r = 0.988).
- Kaplan-Meier adjustments to the total PCBs by homolog methods had the same r as unadjusted results (r = 0.988) and a minor difference in the regression equation to account for slightly higher concentrations.
- Total PCB results from high resolution congener and Aroclor methods also showed a strong relationship (r = 0.879).
- Total PCB results by congeners and homologs had a stronger relationship and lower relative percent difference (RPD) than congeners compared to Aroclors, suggesting homologs by GC/LRMS may be a more accurate and informative PCB analytical procedure than Aroclors as a screening-level method. RPDs averaged about 13% for total PCBs by congeners compared to homologs, while Aroclors compared to congeners or homologs had an RPD of about 60%.
- Sample-estimated detection limits for homologs and Aroclors averaged about 50 and 400 times higher, respectively, than estimated limits for congener analysis.
- Currently no laboratories are accredited under Ecology's Laboratory Accreditation Program to do the PCB homolog method by low resolution GC/MS. Ecology's Manchester Environmental Laboratory should pursue development of a PCB homolog method. Results of this study suggest homolog analysis could be a more informative alternative to Aroclor methods in sediment management.

Recommendations

Results of this 2013 study support the following recommendations:

- Ecology should conduct additional PCB split sample analyses by HRGC/HRMS and GC/LRMS methods to augment study data.
- Studies proposing sediment analyses by Aroclors or congeners should consider including limited split sample analyses by PCB homolog methods. Results could provide Aroclors analysis a quality assurance measure of high or low bias and reference for possible future changes to regulatory methods. These data could augment this study's findings to validate GC/LRMS homolog analysis is an improvement over GC/ECD Aroclors.
- Manchester Laboratory should be funded to (1) pursue standard operating procedure (SOP) and method development for the low resolution PCB homolog analysis by GC/MS and (2) coordinate involvement with Ecology's Laboratory Accreditation Program to get the homolog analysis accredited as an intermediary PCB method.
- Studies targeting total PCB concentrations in sediments with known or suspected weathering should consider GC/LRMS homolog methods as an alternative means to quantify PCBs.

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Appendices

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Appendix A. PCB Results

Table A1. PCB Congener Results from High Resolution HRGC/HRMS Analysis (ng/Kg, dw).

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-001	**18.3**	**32.9**	**3.48**	**2.31**	**26.4**	**34.9**	**38.2**	**75.3**	**18.6**	**62.7**
PCB-002	**8.65**	**2.08**	**1.68**	**4.35**	**10.1**	**9.04**	**6.39**	**10.5**	**19.6**	**6.69**
PCB-003	**16.9**	**6.28**	**4.25**	2.18 U	**26.9**	**36.5**	**29.2**	**86.1**	**12.3**	**28**
PCB-004	**83.3**	**222**	**20.5**	**9.69**	**304**	**99.6**	**209**	**35.1**	**197**	**747**
PCB-005	**5.32**	**12.2**	**1.04**	**0.318 J**	**7**	**9.15**	**16.2**	**4.46**	**1.14**	**3.01**
PCB-006	**158**	**125**	**16.9**	**5.04**	**274**	**99**	**186**	**50.1**	**21.3**	**78.7**
PCB-007	**15.9**	**26.5**	**3.34**	**0.996**	**24.4**	**22.1**	**38.5**	**12.7**	**5.26**	**16.3**
PCB-008	**340**	**535**	**73.2**	**18.3**	**863**	**459**	**896**	**258**	**69.7**	**275**
PCB-009	**16.7**	**34.3**	**4.03**	**1.22**	**37.6**	**27.2**	**52.1**	**12.3**	**4.89**	**15.1**
PCB-010	**3.99**	**11.7**	**1.06**	**0.584**	**11.1**	**5.73**	**12.3**	**1.98**	**11**	**28.3**
PCB-011	**61.7**	**7.42**	**9**	**83.6**	**25.5**	**31.3**	**19.2**	**49.7**	**184**	**20.1**
PCB-012/013	**63.2**	**15.9**	**7.27**	**3.67**	**74.4**	**62.2**	**81.8**	**33.3**	**21.1**	**42.3**
PCB-014	**0.254 NJ**	0.297 UJ	0.133 UJ	0.173 UJ	**1.72 J**	**0.8**	**0.58**	**0.595**	**0.505 NJ**	0.745 UJ
PCB-015	**263**	**151**	**40.2**	**15.6**	**307**	**411**	**593**	**201**	**200**	**433**
PCB-016	**221**	**315**	**77.7**	**15.4**	**720**	**253**	**621**	**130**	**66.5**	**122**
PCB-017	**309**	**299**	**93.2**	**22.7**	**1040**	**292**	**682**	**197**	**107**	**297**
PCB-018/030	**570**	**583**	**157**	**33.5**	**1560**	**549**	**1290**	**295**	**151**	**287**
PCB-019	**54.4**	**67.4**	**19.4**	**12.7**	**206**	**63.6**	**148**	**17.2**	**58.6**	**209**
PCB-020/028	**1320**	**643**	**326**	**91.3**	**3590**	**1470**	**2400**	**853**	**352**	**488**
PCB-021/033	**504**	**415**	**145**	**32.9**	**907**	**586**	**1210**	**420**	**86**	**135**
PCB-022	**369**	**234**	**76.4**	**24.3**	**622**	**425**	**829**	**279**	**83.8**	**123**
PCB-023	**0.93**	**0.933**	**0.265 J**	0.118 UJ	**1.79**	**1.35**	**2.67**	**0.91**	0.428 UJ	**0.43**
PCB-024	**7.12**	**9.62**	**2.38**	**0.543**	**19.3**	**7.62**	**23.7**	**4.77**	**2.73**	**4.94**
PCB-025	**236**	**51.1**	**24.5**	**8.52**	**805**	**160**	**210**	**72.9**	**27.3**	**77.2**
PCB-026/029	**471**	**115**	**44.8**	**15.6**	**2010**	**276**	**398**	**146**	**50.3**	**109**
PCB-027	**71.9**	**41**	**13.1**	**3.96**	**113**	**53.7**	**113**	**24.3**	**29.3**	**91.2**

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-031	1010	518	208	63.7	2200	1040	1880	688	209	347
PCB-032	220	166	69.2 NJ	14	967 NJ	196	457	117	63	164 NJ
PCB-034	8.56	4.81	3.47	0.868	40.1	5.1	7.65	5.65	2.29	4.11
PCB-035	21.7	5.77	2.48	2.02	31.3	26.4	31.6	17.7	9.68	5.4
PCB-036	0.771 UJ	0.647 UJ	0.149 UJ	0.507	1.23 UJ	1 UJ	2.12 UJ	0.648 UJ	2.58	0.338 UJ
PCB-037	305	105	63.4	22	516	425	585	180	122	119
PCB-038	1.87	0.716	0.579	0.155 J	5.71	1.68	2.28 UJ	0.775	0.54 NJ	0.651
PCB-039	8.5	6.04	4.1	1.12	46.4	7.63	11.7	4.5	2.91	3.21
PCB-040/041/071	749	294	187	56	2730	937	1210	306	238	280
PCB-042	402	162	99.7	30.3	1850	601	661	187	132	138
PCB-043	49	17.9	14.1	3.68	128	70.7	95.5	28.6	16.8	21.6
PCB-044/047/065	1940	880	539	144	9520	2710	2450	668	654	672
PCB-045/051	221	93.6	147	29.5	1570	285	447	94	86.7	134
PCB-046	71.6	36.4	27.2	6.33	578	105	163	28.9	34.1	44.6
PCB-048	245	89.4	68.7	18	460	303	463	145	70.8	76.2
PCB-049/069	1480	621	327	98.5	9450	2160	1790	511	425	421
PCB-050/053	240	89.9	88.2	24.9	2210	271	352	72	97	126
PCB-052	3440	1640	467	144	13100	4270	3140	769	957	738
PCB-054	2.99	1	7.98	3.36	75.4	3.82	5.65	0.872	3.02	8.22
PCB-055	30.5	7.19	0.2 UJ	1.38	1.94 UJ	29.9	33	13.6	7.89	0.633 UJ
PCB-056	648	180	127	42.8	1050	753	726	318	207	178
PCB-057	15.7	1.45	1.46	0.508	107	10.1	10.8	4.14	3.45 UJ	3.02
PCB-058	6.56	4.49	2.69	0.765	52.7	12	8.89	2.8	3.5 UJ	3.61
PCB-059/062/075	145	45.1	40.1	10.3	425	221	237	64.2	44	48.6
PCB-060	282	68.7	34.1	14.2	170	327	373	158	90.6	52.8
PCB-061/070/074/076	3100	1210	550	180	6820	4910	3520	1340	1040	797
PCB-063	56.8	18.7	15.2	4.31	241	108	81.2	33.4	22.3	22.4
PCB-064	647	240	144	44	1560	850	912	281	207	198

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-066	**1500**	**480**	**292**	**103**	**4170**	**2730**	**1920**	**703**	**508**	**405**
PCB-067	**56**	**11.4**	**9.12**	**3.17**	**108**	**78.5**	**72.4**	**30.9**	**13.8**	**13.3**
PCB-068	**22.3**	**11.1**	**17.4**	**3.17**	**358**	**62.4**	**28.7**	**7.18**	**10.5**	**12.8**
PCB-072	**35.5**	**17.3**	**13.1**	**3.55**	**442**	**90.6**	**47.9**	**12.1**	**13**	**13.5**
PCB-073	**11.8**	**4.14**	**7.08**	**1.63**	**90.8**	**28.7**	**12.4**	**5.7**	**9.81**	**8.53**
PCB-077	**117**	**24**	**23.5**	**10.1**	**234**	**162**	**141**	**58.5**	**80.6**	**44.2**
PCB-078	1.45 UJ	0.498 UJ	0.192 UJ	0.132 UJ	1.86 UJ	1.51 UJ	3.18 UJ	0.782 UJ	3.17 UJ	0.576 UJ
PCB-079	**38**	**20.5**	**7.11**	**2.62**	**157**	**76.5**	**49**	**10.8**	**17.1**	**12.3**
PCB-080	1.35 UJ	0.463 UJ	0.178 UJ	0.123 UJ	1.73 UJ	1.45 UJ	3.04 UJ	0.747 UJ	3.03 UJ	0.55 UJ
PCB-081	**4.95**	**1.07**	**0.594**	**0.311 J**	**9.28**	**6.88**	**5.12**	**2.24**	3.49 UJ	**1.81**
PCB-082	**452**	**128**	**57.9**	**19.1**	**618**	**1040**	**563**	**104**	**207**	**148**
PCB-083/099	**2500**	**726**	**364**	**131**	**7740**	**7000 NJ**	**3520**	**638**	**1000**	**787**
PCB-084	**1200**	**466**	**143**	**46.6**	**3160**	**2690**	**1420**	**227**	**538**	**376**
PCB-085/116/117	**714**	**187**	**83.1**	**32.6**	**924**	**1750**	**949**	**172**	**262**	**224**
PCB-086/087/097/109/119/125	**3120**	**925**	**361**	**119**	**5860**	**7710**	**3950**	**667**	**1340**	**939**
PCB-088/091	**642**	**206**	**110**	**39.4**	**2820**	**1540**	**797**	**144**	**269**	**217**
PCB-089	**38.6**	**10.6**	**6.39**	**1.95**	**53.9**	**72.1**	**48.3**	**9.86**	**14.6**	**12**
PCB-090/101/113	**6490**	**1440**	**720**	**220**	**12600**	**11700**	**5870**	**1060**	**2000**	**1440**
PCB-092	**1060**	**252**	**158**	**46.9**	**3590**	**2210**	**1110**	**187**	**358**	**285**
PCB-093/095/098/100/102	**5570**	**1420**	**572**	**186**	**11700**	**8390**	**4380**	**701**	**1650**	**1210**
PCB-094	**20.4**	**5.95**	**8.43**	**3.15**	**193**	**42.7**	**26**	**4.47**	**10.3**	**12.9**
PCB-096	**28.6**	**8.94**	**8.62**	**2.7**	**147**	**50.5**	**34.5**	**6.03**	**10.8**	**11**
PCB-103	**54.8**	**13.3**	**21.8**	**7.46**	**503**	**124**	**60.3**	**13.6**	**15**	**17.4**
PCB-104	**0.583**	**0.105 J**	**2.47**	**0.678**	**11.1**	**0.9**	**0.532**	0.176 UJ	**0.198 NJ**	**0.638 NJ**
PCB-105	**1140 NJ**	**350 NJ**	**117**	**51.3 NJ**	**1280**	**3560**	**1760**	**332**	**633 NJ**	**387 NJ**
PCB-106	12.7 UJ	2.61 UJ	0.852 UJ	0.488 UJ	10.1 UJ	17.8 UJ	10.2 UJ	4.41 UJ	10.3 UJ	1.62 UJ
PCB-107	**259**	**72.1**	**46**	**15.9**	**866**	17.2 UJ	**471**	**75.2**	**145**	**105**
PCB-108/124	**136**	**38.2**	**14.9**	**6.29**	**187**	**365**	**184**	**31.4**	**76.2**	**49.7**

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-110/115	**5850**	**1560**	**653**	**220**	**11900**	**13000**	**6410**	**1070**	**2530**	**1730**
PCB-111	**2.98**	0.291 UJ	**1.28**	**0.52 NJ**	**48.7**	**4.35**	**2.79 NJ**	0.72 UJ	0.607 UJ	0.534 UJ
PCB-112	2.44 UJ	0.287 UJ	0.212 UJ	0.135 UJ	4.58 UJ	1.41 UJ	1.29 UJ	0.711 UJ	0.599 UJ	0.527 UJ
PCB-114	**54.9**	**19.3**	**6.9**	**2.81**	**91.8**	**135**	**73.2**	**15.9**	**27.1**	**20.3**
PCB-118	**3150**	**972**	**386**	**141**	**5960**	**10000**	**5000**	**812**	**1530**	**1060**
PCB-120	**18.8**	**2.76**	**5.96**	**2**	**198**	1.31 UJ	**27.1**	0.658 UJ	0.554 UJ	0.488 UJ
PCB-121	2.48 UJ	0.291 UJ	**1.08**	**0.449**	**22.6**	1.47 UJ	1.34 UJ	0.74 UJ	0.623 UJ	**0.803 NJ**
PCB-122	**41.3**	**11.2**	**5.72**	**2.18**	**56.8**	**99.1**	**50.6**	**9.97**	**21**	**17.9**
PCB-123	**43.2**	**11.4**	**4.57**	**2.59**	**51.7**	**107**	**57.2**	**10.4**	**19.6 NJ**	**13.6**
PCB-126	13.8 UJ	3.3 UJ	**1.25**	**0.796**	**28.5 NJ**	18 UJ	10.8 UJ	4.95 UJ	**11.6**	**4.62**
PCB-127	13 UJ	2.67 UJ	0.874 UJ	0.5 UJ	**10.7**	**19.5**	**9.95**	4.22 UJ	9.82 UJ	**2.71 NJ**
PCB-128/166	**1300 NJ**	**183**	**112**	**43**	**1430**	**2470**	**1160**	**155**	**438**	**278**
PCB-129/138/160/163	**13000**	**1000**	**963**	**324**	**13200**	**13600**	**6260**	**1040**	**2460**	**1720**
PCB-130	**587**	**72.9**	**67.4**	**22.2**	**1020**	**952**	**435**	**70.3**	**155**	**104**
PCB-131	**97.8**	**18.1**	**8.67**	**2.82**	**124**	**214**	**99.3**	**13.8**	**28.7**	**20**
PCB-132	**4010**	**405**	**310**	**97.2**	**4950**	**4830**	**2300**	**321**	**800**	**602**
PCB-133	**168**	**14**	**22.4**	**8.18**	**561**	**213**	**94.3**	**16.6**	**30.5**	**23.7**
PCB-134/143	**555**	**63.6**	**44.1**	**15.4**	**847**	**781**	**378**	**52.5**	**110**	**86.7**
PCB-135/151/154	**5630**	**269**	**449**	**145**	**7990**	**3630**	**1650**	**322**	**684**	**545**
PCB-136	**1890**	**143**	**156**	**49**	**2540**	**1440 NJ**	**669**	**114**	**242**	**201**
PCB-137	**201**	**61.9**	**21.4**	**10.6**	**333**	**697**	**318**	**52.7**	**112**	**67.5**
PCB-139/140	**99**	**21.7**	**15.3**	**5.72**	**359**	**316**	**142**	**20.6**	**37.2**	**28.1**
PCB-141	**3400**	**155**	**175**	**56.1**	**2440**	**1510**	**732**	**148**	**379**	**268**
PCB-142	23.7 UJ	1.7 UJ	1.26 UJ	0.655 UJ	18.6 UJ	19.1 UJ	12.6 UJ	2.11 UJ	7.92 UJ	2.4 UJ
PCB-144	**767**	**40**	**50.1**	**14.2**	**592**	**482**	**225**	**42.4**	**85.3**	**68.3**
PCB-145	**2.16**	**0.539 NJ**	**0.324 J**	**0.101 J**	**4.23**	**9.24**	**4.22**	**0.51**	**0.616 J**	**0.504 NJ**
PCB-146	**1510 NJ**	**113 NJ**	**182**	**54.8 NJ**	**4030**	**1960**	**877**	**152**	**328**	**263**
PCB-147/149	**13000**	**740**	**930**	**294**	**14300**	**9350**	**4280**	**777**	**1620**	**1270**

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-148	**12.2**	**1.6**	**5.34**	**2.35**	**176**	**24.1**	**9.87**	**2.11**	**2.28**	**3.59**
PCB-150	**13.4**	**1.78**	**4.58**	**2.26**	**104**	**39.3**	**15.1**	**2.7**	**3.14**	**3.35 NJ**
PCB-152	**4.31**	**1.21**	**1.56**	**0.757**	**22.8**	**14.3**	**6.74**	**0.935**	**1.92**	**1.75 NJ**
PCB-153/168	**13100**	**686**	**938**	**307**	**14300**	**10800**	**4760**	**885**	**1840**	**1360**
PCB-155	**0.395**	0.099 UJ	**0.342 NJ**	**0.303 J**	**3.35**	**4.43**	**1.41**	**0.175 NJ**	0.338 UJ	0.286 UJ
PCB-156/157	**730**	**108**	**65.3**	**24.4**	**993**	**1480**	**699**	**114**	**274**	**181**
PCB-158	**1160**	**107**	**70.3**	**26.3**	**1060**	**1240**	**590**	**100**	**228**	**150**
PCB-159	**195**	**3.35**	**13.6**	**3.63**	**152**	**69.4**	**27.3**	**6.66**	**35**	**25.2**
PCB-161	17.5 UJ	1.25 UJ	0.933 UJ	0.484 UJ	13.8 UJ	13.6 UJ	9 UJ	1.5 UJ	5.3 UJ	1.61 UJ
PCB-162	17.3 UJ	**2.99**	0.925 UJ	**0.849 NJ**	13.7 UJ	**49.5**	**22.6**	**3.73**	**10.5**	**5.2**
PCB-164	**1040**	**73.4**	**78**	**24.6**	**1170**	**905**	**414**	**72.1**	**173**	**130**
PCB-165	**37.3**	1.38 UJ	**2.73**	**0.534 NJ**	**28.7 NJ**	14.9 UJ	9.88 UJ	1.65 UJ	6.25 UJ	1.9 UJ
PCB-167	**320**	**32**	**23.8**	**9.38**	**385**	**505**	**225**	**36.1**	**101**	**64.5**
PCB-169	19 UJ	1.47 UJ	1.86 UJ	0.516 UJ	18.3 UJ	12.3 UJ	8.26 UJ	1.59 UJ	6.34 UJ	2.33 UJ
PCB-170	**5020**	**80.2**	**282**	**86.2**	**4470**	**1940**	**864**	**194**	**513**	**407**
PCB-171/173	**1680**	**29**	**105**	**28.3**	**1630**	**715**	**311**	**62.8**	**161**	**145**
PCB-172	**923**	**13.6**	**55**	**15.7**	**832**	**383**	**159**	**36.4**	**96.7**	**78.1**
PCB-174	**6130**	**83.4**	**372**	**99.9**	**4740**	**2400**	**951**	**207**	**686**	**449**
PCB-175	**258**	**4.09**	**16**	**4.07**	**208**	**131**	**48.1**	**9.64**	**25.1**	**18.5**
PCB-176	**758**	**12.5**	**46.6**	**13.8**	**732**	**311**	**128**	**28**	**75.4**	**52.1**
PCB-177	**3440**	**46.4**	**203**	**57.8**	**3350**	**1230**	**507**	**111**	**335**	**260**
PCB-178	**1160**	**17.7**	**76.8**	**24**	**1210**	**628**	**240**	**45.7**	**137**	**88.3**
PCB-179	**2420**	**38.5**	**157**	**46.7**	**2240**	**1020**	**404**	**83.5 NJ**	**271**	**163**
PCB-180/193	**11700**	**151**	**673**	**206**	**9270**	**4150**	**1760**	**412**	**1170**	**882**
PCB-181	**23.1**	**2.05**	**2.56**	**0.908 NJ**	**44.6**	**333**	**106**	**2.49**	**5.72**	**4.46**
PCB-182	**20.6**	**0.926**	**2.14**	**0.997**	**53.6**	4.32 UJ	**8.16**	**1.45**	0.428 UJ	**3.58**
PCB-183/185	**4010**	**55.2**	**244**	**66.2**	**2840**	**1670**	**698**	**135**	**381**	**295**
PCB-184	**1.74**	0.132 UJ	**0.235 NJ**	**0.329 J**	**3.74**	3.48 UJ	**2.09**	**0.422 NJ**	**1.19**	0.454 UJ

Lab ID (1301022-) Field ID	01 RM-01	02 MC-01	03 FWA-01	04 FWA-02	05 FWA-03	06 MA-01	07 MA-02	08 MB-01	09 FWB-01	10 FWB-02
PCB-186	0.164 UJ	0.145 UJ	0.0931 UJ	0.106 UJ	0.291 UJ	**22**	**6.35**	0.302 UJ	0.364 UJ	0.499 UJ
PCB-187	**5810 NJ**	**94.2**	**407**	**116**	**5290**	**3130**	**1290**	**237**	**793**	**528**
PCB-188	**3.39**	**0.215 J**	**0.878**	**0.418**	**14**	**15.8**	**5.32**	**0.599**	**1.49**	**1.45**
PCB-189	**163**	**3.26**	**10**	**3.04**	**174**	**74.2**	**33.6**	**7.42**	**19.3**	**18.8**
PCB-190	**1130**	**15.8**	**57.8**	**18.2**	**882**	**424**	**175**	**36.2**	**118**	**86.8**
PCB-191	**208**	**3.4**	**12.6**	**3.14**	**204**	**86.6**	**35.2**	**8.05**	**20**	**17.4**
PCB-192	0.175 UJ	0.155 UJ	0.0992 UJ	0.113 UJ	0.31 UJ	3.88 UJ	1.7 UJ	0.318 UJ	0.384 UJ	0.592 UJ
PCB-194	**2520**	**29.1**	**164**	**54.3**	**2010**	**2010**	**703**	**102**	**319**	**191**
PCB-195	**1150**	**10.7**	**68.1**	**23.2**	**905**	**527**	**196**	**38.2**	**136**	**53.4 NJ**
PCB-196	**1450**	**18.5**	**96.4**	**28.2**	**1040**	**891**	**328**	**58.5**	**185**	**113**
PCB-197/200	**178 NJ**	**5.75 NJ**	**29.3 NJ**	**3.97 NJ**	**300 NJ**	**295 NJ**	**122 NJ**	**19.6 NJ**	**30.4 NJ**	**16.4 NJ**
PCB-198/199	**3010 NJ**	**48.9**	**237**	**62.1 NJ**	**1890**	**3630**	**1290**	**131**	**458 NJ**	**258**
PCB-201	**350**	**5.89**	**25**	**7.67**	**282**	**275**	**108**	**18.6**	**57.7**	**36**
PCB-202	**463**	**10.6**	**52.7**	**14**	**379**	**610**	**225**	**28.8**	**98.6**	**61.1**
PCB-203	**1800**	**27.1**	**131**	**41.7**	**1120**	**1430**	**565**	**79.8**	**299**	**177**
PCB-204	**0.75**	0.0493 UJ	**0.23 NJ**	**0.115 NJ**	**1.15**	**13.7**	**4.81 NJ**	0.22 UJ	0.415 UJ	0.231 UJ
PCB-205	**119**	**1.07**	**7.79**	**2.49**	**95.7**	**112**	**36**	**4.38**	**15.7**	**8.94**
PCB-206	**532**	**27.6**	**409**	**45.8**	**489**	**3190**	**1240**	**36.1**	**145**	**141**
PCB-207	**82.1**	**3.86**	**32**	**5.22**	**75.6**	**216**	**88.3**	**7.62**	**25.6**	**25.4**
PCB-208	**125**	**11.5**	**196**	**19.4**	**167**	**1160**	**375**	**27.2**	**70**	**58.5 NJ**
PCB-209	**99.2**	**47.2**	**504**	**52**	**299**	**7180**	**1600**	**60.4**	**148**	**257**

Bold = Visual aid for detected compounds.
U = Analyte not found at the limit shown.
J = Analyte positively identified, result is an estimate.
NJ = Analyte tentatively identified, result is approximate.
UJ = Analyte not found at the estimated reporting limit shown.

Table A2. PCB Congener Results for Homolog Analyses from GC/LRMS Methods (ng/Kg, dw).

Lab ID (1301022-) / Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-001	**498**		122	UJ	**509**	**NJ**	90.3	UJ	**1220**	**NJ**	99.9	UJ	45.1	UJ	**230**	**NJ**	**385**	**NJ**	**432**	**NJ**
PCB-002	71	UJ	120	UJ	164	UJ	88.8	UJ	318	UJ	98.3	UJ	44.4	UJ	131	UJ	169	UJ	277	UJ
PCB-003	71	UJ	120	UJ	164	UJ	88.8	UJ	318	UJ	98.3	UJ	44.4	UJ	131	UJ	169	UJ	277	UJ
PCB-004/010	204	UJ	**379**		239	UJ	39.7	UJ	**347**		273	UJ	**205**		267	UJ	**230**		**636**	
PCB-008/005	**474**		**627**		**267**		**93.3**	**J**	**1160**		**537**		**832**		**297**		**1230**	**NJ**	**758**	
PCB-006	**161**	**J**	**131**	**J**	133	UJ	22.1	UJ	**289**		152	UJ	**148**	**J**	149	UJ	97.2	UJ	209	UJ
PCB-007/009	114	UJ	104	UJ	133	UJ	22.1	UJ	166	UJ	152	UJ	105	UJ	149	UJ	97.2	UJ	**434**	
PCB-011	114	UJ	**104**	**J**	133	UJ	**38.5**	**J**	166	UJ	152	UJ	105	UJ	149	UJ	97.2	UJ	209	UJ
PCB-012/013	114	UJ	104	UJ	133	UJ	**64.7**	**J**	**543**		152	UJ	105	UJ	149	UJ	**677**		**352**	
PCB-014	114	UJ	104	UJ	133	UJ	22.1	UJ	166	UJ	152	UJ	105	UJ	149	UJ	97.2	UJ	209	UJ
PCB-015	**348**	**J**	**212**	**NJ**	140	UJ	**38.3**	**NJ**	175	UJ	**481**		**585**		**228**		**678**	**NJ**	**412**	
PCB-016/032	**633**		**589**		**309**		**75.4**	**J**	**2640**		**589**		**1200**		**265**		233	UJ	**706**	
PCB-017	**366**	**J**	**346**		58	UJ	52.8	UJ	**1490**		**389**		**645**		204	UJ	**461**		**569**	
PCB-018	**786**		**787**		**276**		52.8	UJ	**2190**		**751**		**1390**		**325**		**511**		**472**	
PCB-019	219	UJ	132	UJ	64.8	UJ	59	UJ	402	UJ	234	UJ	211	UJ	229	UJ	260	UJ	369	UJ
PCB-033/020/021	**701**		**7360**	**NJ**	**785**		**1610**	**NJ**	**2240**		**930**		**1490**		**1820**	**NJ**	199	UJ	**965**	
PCB-022	**361**	**J**	**305**		141	UJ	71.2	UJ	518	UJ	**383**		**744**		236	UJ	199	UJ	401	UJ
PCB-034/023	114	UJ	**696**	**NJ**	**40.6**	**NJ**	**299**	**NJ**	**299**	**NJ**	122	UJ	110	UJ	119	UJ	136	UJ	193	UJ
PCB-024/027	196	UJ	**131**	**J**	58	UJ	52.8	UJ	**414**		210	UJ	**218**		204	UJ	233	UJ	**354**	
PCB-025	**352**	**J**	**93.6**	**NJ**	**38.3**	**NJ**	30.8	UJ	**1100**		**284**		**274**		119	UJ	136	UJ	193	UJ
PCB-026	**513**		**116**	**NJ**	33.8	UJ	30.8	UJ	**1620**		**388**		**395**		**794**	**NJ**	**156**	**NJ**	**223**	**NJ**
PCB-028	**1120**		**574**		**275**		**81**	**J**	**3220**		**1300**		**1850**		**630**		**442**		**623**	
PCB-029	114	UJ	**72.9**	**J**	**45.1**	**NJ**	**43.2**	**NJ**	**217**	**NJ**	**138**	**NJ**	**111**	**J**	119	UJ	136	UJ	193	UJ
PCB-030	196	UJ	118	UJ	58	UJ	52.8	UJ	360	UJ	210	UJ	189	UJ	204	UJ	233	UJ	330	UJ
PCB-031	**1100**		**565**		**302**		**65.1**	**J**	**2300**		**1150**		**2040**		**546**		**237**		**410**	
PCB-035	**1030**	**NJ**	**2630**	**NJ**	145	UJ	**617**	**NJ**	**2640**	**NJ**	**1690**	**NJ**	**1020**	**NJ**	**5490**	**NJ**	**454**	**NJ**	**4100**	**NJ**
PCB-036	132	UJ	115	UJ	141	UJ	71.2	UJ	518	UJ	313	UJ	217	UJ	236	UJ	199	UJ	401	UJ

Lab ID (1301022-) Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-037	**370**	**J**	**179**	**J**	145	UJ	72.9	UJ	530	UJ	**438**		**675**		242	UJ	204	UJ	411	UJ
PCB-038	135	UJ	118	UJ	145	UJ	72.9	UJ	530	UJ	321	UJ	222	UJ	242	UJ	204	UJ	411	UJ
PCB-0039	132	UJ	115	UJ	**233**		71.2	UJ	518	UJ	313	UJ	217	UJ	717	NJ	251	NJ	401	UJ
PCB-040	**306**	**J**	**164**	**J**	129	UJ	54.6	UJ	651	UJ	558	UJ	**374**		274	UJ	**556**		411	UJ
PCB-041/071/064/068	**1800**		**685**		**350**		**152**	**J**	**6780**		**2100**		**2350**		**739**		**448**		**828**	
PCB-042/059	**517**		**242**		80.8	UJ	57.7	UJ	**1950**		**790**		**874**		119	UJ	136	UJ	**306**	
PCB-049/043	**1520**		**647**		**352**		**124**	**J**	**8850**		**1930**		**1700**		**578**		**553**		**719**	
PCB-044	**1740**		**804**		**286**		**83.1**	**J**	**4260**		**1900**		**1780**		**370**		**896**		**789**	
PCB-045	**170**	**J**	**62.6**	**J**	70.7	UJ	50.5	UJ	**330**		**205**		**272**		104	UJ	119	UJ	160	UJ
PCB-046	68	UJ	59.8	UJ	70.7	UJ	50.5	UJ	**405**		156	UJ	**113**	**J**	104	UJ	119	UJ	160	UJ
PCB-047/048/075	**708**		**282**		**373**		**87**	**J**	**5950**		**1080**		**1110**		**300**		**390**		**447**	
PCB-050	55	UJ	48	UJ	56.7	UJ	40.5	UJ	119	UJ	125	UJ	68.8	UJ	83.8	UJ	95.7	UJ	128	UJ
PCB-051	68	UJ	59.8	UJ	**101**	**J**	50.5	UJ	**1250**		156	UJ	**94**	**J**	104	UJ	119	UJ	160	UJ
PCB-052/073	**3380**		**1610**		**465**		**150**	**J**	**11600**		**3690**		**2820**		**631**		**1020**		**1130**	
PCB-053	**254**	**J**	**94.7**	**J**	**103**	**J**	50.5	UJ	**2100**		**234**		**338**		104	UJ	119	UJ	160	UJ
PCB-054	55	UJ	48	UJ	56.7	UJ	40.5	UJ	119	UJ	125	UJ	68.8	UJ	83.8	UJ	95.7	UJ	128	UJ
PCB-055	150	UJ	60.9	UJ	68.7	UJ	29.1	UJ	347	UJ	297	UJ	147	UJ	146	UJ	178	UJ	219	UJ
PCB-056/060	**915**		**296**		**153**	**J**	**71.8**	**J**	**1200**		**1100**		**1070**		**403**		**692**		**355**	
PCB-057	281	UJ	114	UJ	129	UJ	54.6	UJ	651	UJ	558	UJ	276	UJ	274	UJ	335	UJ	411	UJ
PCB-058	281	UJ	114	UJ	129	UJ	54.6	UJ	651	UJ	558	UJ	276	UJ	274	UJ	335	UJ	411	UJ
PCB-074/061	**743**		**284**		**229**		**66.9**	**J**	**1380**		**1080**		**977**		**371**		**370**		**354**	
PCB-065/062	68	UJ	59.8	UJ	70.7	UJ	50.5	UJ	148	UJ	156	UJ	85.8	UJ	104	UJ	119	UJ	160	UJ
PCB-063	140	UJ	56.9	UJ	64.1	UJ	27.1	UJ	324	UJ	278	UJ	**160**	**NJ**	136	UJ	167	UJ	204	UJ
PCB-066/080	**1550**		**563**		**243**	**NJ**	**135**	**J**	**4420**		**2750**		**2050**		**604**		**586**		**676**	
PCB-067	281	UJ	114	UJ	129	UJ	54.6	UJ	651	UJ	558	UJ	276	UJ	274	UJ	335	UJ	411	UJ
PCB-069	68	UJ	59.8	UJ	70.7	UJ	50.5	UJ	148	UJ	156	UJ	85.8	UJ	104	UJ	119	UJ	160	UJ
PCB-070/076	**2190**		**956**		**384**		**132**	**J**	**4830**		**3200**		**2370**		**740**		**768**		**833**	
PCB-072	78	UJ	68.4	UJ	80.8	UJ	57.7	UJ	**875**	**NJ**	**180**	**NJ**	**102**	**NJ**	119	UJ	**173**	**J**	183	UJ

Lab ID (1301022-) Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-077	**297**	**NJ**	90.6	UJ	64.9	UJ	112	UJ	**718**	**NJ**	**354**	**NJ**	270	UJ	137	UJ	459	UJ	**281**	**NJ**
PCB-078	165	UJ	90.6	UJ	64.9	UJ	112	UJ	279	UJ	175	UJ	270	UJ	137	UJ	459	UJ	149	UJ
PCB-079	165	UJ	90.6	UJ	64.9	UJ	112	UJ	279	UJ	175	UJ	270	UJ	137	UJ	459	UJ	149	UJ
PCB-081	165	UJ	90.6	UJ	64.9	UJ	112	UJ	279	UJ	175	UJ	270	UJ	**1230**	**NJ**	459	UJ	149	UJ
PCB-082	**495**		**453**	**NJ**	138	UJ	**77.6**	**NJ**	**632**		**1180**		**624**		350	UJ	212	UJ	**310**	**NJ**
PCB-083/108	**219**	**J**	**194**		39	UJ	27.6	UJ	**685**		**558**		**269**		38	UJ	**98.5**	**J**	106	UJ
PCB-084	**904**		**405**		**96.3**	**J**	**44.2**	**J**	**2170**		**1700**		**952**		**152**	**J**	**378**		**385**	
PCB-085/120	**677**		**242**		138	UJ	53.5	UJ	**840**		**1860**		**938**		350	UJ	**349**		**259**	
PCB-097/086	**1310**		**590**		**197**		**56.9**	**J**	**2660**		**3270**		**1740**		350	UJ	**685**		**638**	
PCB-087/115/116	**2070**		**852**		**200**		**78.8**	**J**	**2260**		**3980**		**2010**		**355**		**987**		**865**	
PCB-088/121	53	UJ	36.8	UJ	39.1	UJ	27.7	UJ	102	UJ	122	UJ	75.6	UJ	38.1	UJ	78.1	UJ	106	UJ
PCB-090/101/89	**6570**		**1730**		**650**		**227**		**10600**		**9980**		**5190**		**825**		**2080**		**1960**	
PCB-091	**613**		**220**		**99**	**J**	**34.4**	**J**	**2780**		**1110**		**637**		**124**	**J**	**318**		**313**	
PCB-092	**958**		**265**		**138**	**J**	**45.3**	**J**	**2790**		**1690**		**869**		**157**	**J**	**431**		**379**	
PCB-095/093	**5570**		**1560**		**480**		**183**	**J**	**9580**		**6640**		**3560**		**487**		**1560**		**1600**	
PCB-094	53	UJ	36.8	UJ	39.1	UJ	27.7	UJ	**220**		122	UJ	75.6	UJ	38.1	UJ	78.1	UJ	106	UJ
PCB-096	53	UJ	36.8	UJ	39.1	UJ	27.7	UJ	**209**		122	UJ	75.6	UJ	38.1	UJ	78.1	UJ	106	UJ
PCB-098/102	**114**	**J**	**57.8**	**J**	39.1	UJ	27.7	UJ	**428**		**243**		**154**	**J**	38.1	UJ	78.1	UJ	106	UJ
PCB-099	**1730**		**626**		**233**		**103**	**J**	**4960**		**4360**		**2280**		**372**		**792**		**827**	
PCB-100	53	UJ	36.8	UJ	39.1	UJ	27.7	UJ	**391**		122	UJ	75.6	UJ	38.1	UJ	78.1	UJ	106	UJ
PCB-103	**68**	**J**	36.8	UJ	39.1	UJ	27.7	UJ	**506**		122	UJ	75.6	UJ	38.1	UJ	78.1	UJ	106	UJ
PCB-104	37	UJ	25.6	UJ	27.2	UJ	19.2	UJ	70.6	UJ	84.5	UJ	52.6	UJ	26.5	UJ	54.3	UJ	73.6	UJ
PCB-105/127	**1260**		**574**		**115**	**J**	**55**	**J**	**997**		**3430**		**1780**		**285**		**882**		**577**	
PCB-118/106	**3370**		**1380**		**527**		**187**	**J**	**5560**		**9760**		**4830**		**840**		**1780**		**1630**	
PCB-107/109	**321**	**J**	111	UJ	93.5	UJ	36.3	UJ	**763**		**876**		**390**		237	UJ	144	UJ	**233**	**NJ**
PCB-110	**5300**		**1730**		**583**		**212**		**10100**		**10700**		**5550**		**834**		**2460**		**2410**	
PCB-111/117	**215**	**J**	164	UJ	138	UJ	53.5	UJ	415	UJ	472	UJ	**243**		350	UJ	212	UJ	224	UJ
PCB-112	53	UJ	36.7	UJ	39	UJ	27.6	UJ	**1260**		121	UJ	**264**		38	UJ	77.9	UJ	106	UJ

Lab ID (1301022-) / Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-113	46	UJ	32.5	UJ	34.5	UJ	24.4	UJ	**243**		**140**	**J**	66.7	UJ	33.6	UJ	68.9	UJ	93.4	UJ
PCB-114	95	UJ	107	UJ	89.8	UJ	34.9	UJ	271	UJ	308	UJ	113	UJ	228	UJ	138	UJ	146	UJ
PCB-119	**146**	**J**	**42.1**	**J**	**33.5**	**NJ**	21.5	UJ	79	UJ	**387**		58.8	UJ	29.7	UJ	60.7	UJ	82.4	UJ
PCB-122	95	UJ	107	UJ	89.8	UJ	34.9	UJ	271	UJ	308	UJ	113	UJ	228	UJ	138	UJ	146	UJ
PCB-123	109	UJ	124	UJ	98.3	UJ	35.8	UJ	263	UJ	322	UJ	126	UJ	240	UJ	131	UJ	142	UJ
PCB-124	**281**	**J**	**125**	**J**	93.5	UJ	36.3	UJ	281	UJ	**533**		**230**		237	UJ	144	UJ	152	UJ
PCB-125	145	UJ	164	UJ	138	UJ	53.5	UJ	415	UJ	472	UJ	173	UJ	350	UJ	212	UJ	224	UJ
PCB-126	101	UJ	115	UJ	96.3	UJ	37.4	UJ	290	UJ	330	UJ	121	UJ	244	UJ	347	NJ	181	NJ
PCB-128	**1310**		39	UJ	158	UJ	**52.9**	**J**	**1110**		**2590**		**1240**		**214**		**445**		**557**	
PCB-129	**388**		**80.6**	**J**	158	UJ	42.3	UJ	**316**		**549**		**305**		113	UJ	168	UJ	189	UJ
PCB-130	**568**		**72.7**	**J**	158	UJ	42.3	UJ	**545**		**832**		**427**		113	UJ	168	UJ	189	UJ
PCB-131/142	139	UJ	41	UJ	78.6	UJ	26	UJ	119	UJ	**156**	**J**	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-132/168	**3090**		**398**		**203**		**91.7**	**J**	**2280**		**3210**		**1410**		**236**		144	UJ	**461**	
PCB-133	**142**	J	41	UJ	78.6	UJ	26	UJ	**259**		**168**	**J**	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-134/143	**439**		**66.6**	**J**	78.6	UJ	26	UJ	**521**		**590**		**292**		**67.3**	**J**	**215**		**124**	**J**
PCB-144/135	**2280**		**162**	**J**	**151**	**J**	**61.7**	**J**	**1880**		**1590**		**761**		**152**	**J**	**385**		**383**	
PCB-136	**2470**		**185**		**164**	**J**	**57.1**	**J**	**2110**		**1550**		**739**		**120**	**J**	**332**		**387**	
PCB-137	**251**	J	**72.3**	**J**	134	UJ	35.9	UJ	**266**		**616**		**301**		95.9	UJ	143	UJ	160	UJ
PCB-138/163/164	**14400**		**1280**		**976**		**367**		**8550**		**13100**		**6200**		**929**		**2860**		**2680**	
PCB-149/139	**11500**		**780**		**738**		**280**		**8540**		**7910**		**3620**		**600**		**1790**		**1710**	
PCB-140	139	UJ	41	UJ	78.6	UJ	26	UJ	**142**	**J**	131	UJ	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-141	**3090**		**173**	**J**	**168**	**J**	**59.1**	**J**	**1210**		**1340**		**687**		**149**	**J**	**601**		**577**	
PCB-145	139	UJ	41	UJ	78.6	UJ	26	UJ	119	UJ	131	UJ	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-146	**1530**		**121**	**J**	**147**	**J**	**59.6**	**J**	**1780**		**1480**		**663**		**118**	**J**	**342**		**302**	
PCB-147	139	UJ	41	UJ	78.6	UJ	26	UJ	**324**		**339**		**152**	**J**	61.2	UJ	130	UJ	96.7	UJ
PCB-148	139	UJ	41	UJ	78.6	UJ	26	UJ	119	UJ	131	UJ	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-150	139	UJ	41	UJ	78.6	UJ	26	UJ	119	UJ	131	UJ	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-151	**3840**		**165**	**J**	**231**		**84.8**	**J**	**2420**		**1770**		**790**		**167**	**J**	**465**		**437**	

Lab ID (1301022-) Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-152	139	UJ	41	UJ	78.6	UJ	26	UJ	119	UJ	131	UJ	135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-153	**13500**		**789**		**914**		**315**		**8430**		**9290**		**4340**		**685**		**2640**		**2040**	
PCB-154	139	UJ	41	UJ	78.6	UJ	26	UJ	**488**		**238**		135	UJ	61.2	UJ	130	UJ	96.7	UJ
PCB-155	92	UJ	27	UJ	51.8	UJ	17.1	UJ	78.1	UJ	86.6	UJ	88.9	UJ	40.3	UJ	85.3	UJ	63.7	UJ
PCB-156	**712**		**140**	**J**	99.6	UJ	**34.8**	**J**	**577**		**1150**		**572**		**119**	**J**	**270**		**221**	
PCB-157	**276**	**J**	25.4	UJ	102	UJ	27.5	UJ	**162**	**J**	**425**		**173**	**J**	73.3	UJ	109	UJ	123	UJ
PCB-158/160	**1520**		**185**		134	UJ	**40**	**J**	**825**		**1520**		**778**		**131**	**J**	**303**		**294**	
PCB-159	**325**	**J**	33.2	UJ	134	UJ	35.9	UJ	136	UJ	198	UJ	96	UJ	95.9	UJ	143	UJ	160	UJ
PCB-161	115	UJ	33.8	UJ	64.7	UJ	21.4	UJ	97.7	UJ	108	UJ	111	UJ	50.4	UJ	107	UJ	79.6	UJ
PCB-162	**174**	**J**	**33.7**	**NJ**	134	UJ	35.9	UJ	136	UJ	198	UJ	96	UJ	95.9	UJ	143	UJ	160	UJ
PCB-165	115	UJ	33.8	UJ	64.7	UJ	21.4	UJ	97.7	UJ	108	UJ	111	UJ	50.4	UJ	107	UJ	79.6	UJ
PCB-166	92	UJ	33.2	UJ	134	UJ	35.9	UJ	136	UJ	198	UJ	96	UJ	95.9	UJ	143	UJ	160	UJ
PCB-167	**314**	**J**	24.4	UJ	98.6	UJ	26.5	UJ	245		514		222		89.9	J	112	J	118	UJ
PCB-169	73	UJ	**36.2**	**NJ**	142	J	29.8	NJ	148	NJ	158	UJ	76.4	UJ	102	NJ	113	UJ	128	UJ
PCB-170/190	**6780**		**187**	**J**	**409**		**164**	**J**	**2610**		**2500**		**1140**		**283**		**786**		**720**	
PCB-171	**1270**		**48.2**	**J**	**84**	**J**	**27.8**	**J**	**547**		**469**		**216**		**43.5**	**J**	172	UJ	131	UJ
PCB-172/192	**742**		38.8	UJ	**51.6**	**J**	17.5	UJ	**314**		**334**		**136**	**J**	36.5	UJ	172	UJ	131	UJ
PCB-173	**120**	**J**	38.8	UJ	32.5	UJ	17.5	UJ	121	UJ	110	UJ	83.1	UJ	36.5	UJ	172	UJ	131	UJ
PCB-174/181	**4570**		**106**	**J**	**255**		**95.9**	**J**	**1950**		**1800**		**737**		**147**	**J**	**454**		**458**	
PCB-175	**203**	**J**	37.7	UJ	31.6	UJ	17	UJ	118	UJ	107	UJ	80.7	UJ	35.4	UJ	167	UJ	127	UJ
PCB-176	**671**		28.6	UJ	**36.7**	**J**	**17.8**	**J**	**311**		**233**		**95**	**J**	**32.7**	**J**	127	UJ	96.4	UJ
PCB-177	**2570**		**58**	**J**	**146**	**J**	**56.3**	**J**	**1150**		**873**		**356**		**87.4**	**J**	**257**		**231**	
PCB-178	**927**		37.7	UJ	**64.6**	**J**	**31.6**	**J**	**498**		**407**		**159**	**J**	**41.1**	**J**	167	UJ	127	UJ
PCB-179	**2290**		**54.5**	**J**	**121**	**J**	**49.4**	**J**	**1090**		**785**		**300**		**74.9**	**J**	**214**		**207**	
PCB-180	**11900**		**248**		**647**		**236**		**4480**		**3750**		**1620**		**386**		**1290**		**1060**	
PCB-187/182	**6260**		**130**	**J**	**380**		**138**	**J**	**2900**		**2800**		**1070**		**212**	**J**	**715**		**579**	
PCB-183	**3000**		**65.8**	**J**	**157**	**J**	**61.7**	**J**	**1180**		**1130**		**459**		**105**	**J**	**296**		**298**	
PCB-184	26	UJ	28.6	UJ	24	UJ	12.9	UJ	89.4	UJ	81.2	UJ	61.3	UJ	26.9	UJ	127	UJ	96.4	UJ

Lab ID (1301022-) Field ID	01 RM-01		02 MC-01		03 FWA-01		04 FWA-02		05 FWA-03		06 MA-01		07 MA-02		08 MB-01		09 FWB-01		10 FWB-02	
PCB-185	**583**		36.7	UJ	**32.5**	**J**	16.5	UJ	**231**		**225**		**93.7**	**J**	34.5	UJ	162	UJ	124	UJ
PCB-186	34	UJ	37.7	UJ	31.6	UJ	17	UJ	118	UJ	107	UJ	80.7	UJ	35.4	UJ	167	UJ	127	UJ
PCB-188	26	UJ	28.6	UJ	24	UJ	12.9	UJ	89.4	UJ	81.2	UJ	61.3	UJ	26.9	UJ	127	UJ	96.4	UJ
PCB-189	**190**	**J**	30.7	UJ	25.7	UJ	13.8	UJ	95.8	UJ	87	UJ	65.7	UJ	28.8	UJ	136	UJ	103	UJ
PCB-191	**254**	**J**	38.8	UJ	32.5	UJ	17.5	UJ	**138**	**J**	110	UJ	83.1	UJ	36.5	UJ	172	UJ	131	UJ
PCB-193	**682**		38.8	UJ	**37.9**	**J**	**18.8**	**J**	**276**		**299**		**109**	**J**	**40.6**	**J**	172	UJ	131	UJ
PCB-194	**2360**		65.3	UJ	**136**	**J**	**75.5**	**J**	**1000**		**1870**		**686**		138	UJ	**484**		191	UJ
PCB-195	**1010**		65.3	UJ	84.9	UJ	72.3	UJ	**431**		**535**		**192**		138	UJ	**122**	**J**	191	UJ
PCB-196/203	**2880**		**88.8**	**J**	**213**		**108**	**J**	**1320**		**2170**		**821**		**158**	**J**	**499**		**351**	
PCB-197	**87**	**J**	39.9	UJ	51.9	UJ	44.2	UJ	51.8	UJ	89.6	UJ	57.5	UJ	84.4	UJ	57.9	UJ	117	UJ
PCB-198	**132**	**J**	65	UJ	84.6	UJ	72.1	UJ	84.4	UJ	146	UJ	93.7	UJ	138	UJ	94.3	UJ	190	UJ
PCB-199	**2310**		65	UJ	**191**		**109**	**J**	**1060**		**2800**		**990**		138	UJ	**466**		**363**	
PCB-200	**257**	**J**	39.9	UJ	51.9	UJ	44.2	UJ	**116**	**J**	**170**	**J**	**65.4**	**J**	84.4	UJ	**58**	**J**	117	UJ
PCB-201	**268**	**J**	39.9	UJ	51.9	UJ	44.2	UJ	**131**	**J**	**184**		**70.6**	**J**	84.4	UJ	57.9	UJ	117	UJ
PCB-202	**452**		54	UJ	70.3	UJ	59.9	UJ	**248**		**531**		**189**		114	UJ	**117**	**J**	158	UJ
PCB-204	57	UJ	39.9	UJ	51.9	UJ	44.2	UJ	51.8	UJ	89.6	UJ	57.5	UJ	84.4	UJ	57.9	UJ	117	UJ
PCB-205	**134**	**J**	50.8	UJ	66.1	UJ	56.3	UJ	**76.8**	**NJ**	114	UJ	73.3	UJ	108	UJ	73.7	UJ	149	UJ
PCB-206	**588**		89.5	UJ	**570**		**96.1**	**J**	**523**		**4640**		**1350**		121	UJ	287	UJ	**300**	
PCB-207	**96**	**J**	71.4	UJ	**62.5**	**J**	60	UJ	**70.5**	**J**	**295**		**126**	**J**	96.4	UJ	229	UJ	158	UJ
PCB-208	**131**	**J**	71.4	UJ	**234**		60	UJ	**179**	**J**	**1120**		**327**		96.4	UJ	229	UJ	158	UJ
PCB-209	**106**	**J**	**180**	**J**	**707**		**130**	**J**	**556**		**6180**		**1650**		**104**	**J**	**210**		**481**	

Bold = Visual aid for detected compounds.

J = Analyte positively identified, result is an estimate.

NJ = Analyte tentatively identified, result is approximate.

UJ = Analyte not found at the estimated reporting limit shown.

Table A3. PCB Aroclor Results from GC/ECD Analyses (ug/Kg, dw) and Percent Solids.

Field ID	Lab ID	Parameter	Result	RL	DL
RM01	1301022-01	PCB-aroclor-1016	16 U	16	3.6
RM01	1301022-01	PCB-aroclor-1221	7.9 U	7.9	1.7
RM01	1301022-01	PCB-aroclor-1232	16 U	16	4.6
RM01	1301022-01	PCB-aroclor-1242	16 UJ	7.9	1
RM01	1301022-01	PCB-aroclor-1248	26 UJ	7.9	1
RM01	1301022-01	PCB-aroclor-1254	**53**	7.9	0.24
RM01	1301022-01	PCB-aroclor-1260	**90**	7.9	0.89
RM01	1301022-01	PCB-aroclor-1262	63 UJ	7.9	0.34
RM01	1301022-01	PCB-aroclor-1268	7.9 U	7.9	0.39
RM01	1301022-01	Percent Solids	**100%**	0.001	NA
MC01	1301022-02	PCB-aroclor-1016	9 U	9	2
MC01	1301022-02	PCB-aroclor-1221	4.5 U	4.5	0.99
MC01	1301022-02	PCB-aroclor-1232	9 U	9	2.6
MC01	1301022-02	PCB-aroclor-1242	4.5 U	4.5	0.58
MC01	1301022-02	PCB-aroclor-1248	4.5 U	4.5	0.57
MC01	1301022-02	PCB-aroclor-1254	**6.2**	4.5	0.14
MC01	1301022-02	PCB-aroclor-1260	4.5 U	4.5	0.51
MC01	1301022-02	PCB-aroclor-1262	4.5 U	4.5	0.19
MC01	1301022-02	PCB-aroclor-1268	4.5 U	4.5	0.23
MC01	1301022-02	Percent Solids	**55.5%**	0.001	NA
FWA01	1301022-03	PCB-aroclor-1016	6.3 U	6.3	1.4
FWA01	1301022-03	PCB-aroclor-1221	3.2 U	3.2	0.69
FWA01	1301022-03	PCB-aroclor-1232	6.3 U	6.3	1.8
FWA01	1301022-03	PCB-aroclor-1242	3.2 U	3.2	0.41
FWA01	1301022-03	PCB-aroclor-1248	**4.4 J**	3.2	0.4
FWA01	1301022-03	PCB-aroclor-1254	**6.4**	3.2	0.096
FWA01	1301022-03	PCB-aroclor-1260	**5 J**	3.2	0.36
FWA01	1301022-03	PCB-aroclor-1262	6.3 UJ	3.2	0.14
FWA01	1301022-03	PCB-aroclor-1268	3.2 U	3.2	0.16
FWA01	1301022-03	Percent Solids	**78.7%**	0.001	NA
FWA02	1301022-04	PCB-aroclor-1016	7.3 U	7.3	1.6
FWA02	1301022-04	PCB-aroclor-1221	3.6 U	3.6	0.8
FWA02	1301022-04	PCB-aroclor-1232	7.3 U	7.3	2.1
FWA02	1301022-04	PCB-aroclor-1242	3.6 U	3.6	0.47
FWA02	1301022-04	PCB-aroclor-1248	3.6 U	3.6	0.46
FWA02	1301022-04	PCB-aroclor-1254	3.6 U	3.6	0.11
FWA02	1301022-04	PCB-aroclor-1260	3.6 U	3.6	0.41
FWA02	1301022-04	PCB-aroclor-1262	3.6 U	3.6	0.16
FWA02	1301022-04	PCB-aroclor-1268	3.6 U	3.6	0.18

Field ID	Lab ID	Parameter	Result	RL	DL
FWA02	1301022-04	Percent Solids	**68.3%**	0.001	NA
FWA03	1301022-05	PCB-aroclor-1016	11 UJ	6.8	1.5
FWA03	1301022-05	PCB-aroclor-1221	6.8 UJ	3.4	0.74
FWA03	1301022-05	PCB-aroclor-1232	6.8 U	6.8	2
FWA03	1301022-05	PCB-aroclor-1242	14 UJ	3.4	0.44
FWA03	1301022-05	PCB-aroclor-1248	**31 J**	3.4	0.43
FWA03	1301022-05	PCB-aroclor-1254	**46 J**	3.4	0.1
FWA03	1301022-05	PCB-aroclor-1260	**21 J**	3.4	0.38
FWA03	1301022-05	PCB-aroclor-1262	20 UJ	3.4	0.15
FWA03	1301022-05	PCB-aroclor-1268	3.4 U	3.4	0.17
FWA03	1301022-05	Percent Solids	**73.2%**	0.001	NA
MA01	1301022-06	PCB-aroclor-1016	15 UJ	7.7	1.7
MA01	1301022-06	PCB-aroclor-1221	31 UJ	3.8	0.84
MA01	1301022-06	PCB-aroclor-1232	31 UJ	7.7	2.2
MA01	1301022-06	PCB-aroclor-1242	15 UJ	3.8	0.49
MA01	1301022-06	PCB-aroclor-1248	**32 J**	3.8	0.49
MA01	1301022-06	PCB-aroclor-1254	**51**	3.8	0.12
MA01	1301022-06	PCB-aroclor-1260	**31 J**	3.8	0.43
MA01	1301022-06	PCB-aroclor-1262	31 UJ	3.8	0.16
MA01	1301022-06	PCB-aroclor-1268	15 UJ	3.8	0.19
MA01	1301022-06	Percent Solids	**63.6%**	0.001	NA
MA02	1301022-07	PCB-aroclor-1016	25 UJ	6.1	1.4
MA02	1301022-07	PCB-aroclor-1221	12 UJ	3.1	0.67
MA02	1301022-07	PCB-aroclor-1232	25 UJ	6.1	1.8
MA02	1301022-07	PCB-aroclor-1242	25 UJ	3.1	0.4
MA02	1301022-07	PCB-aroclor-1248	**37 J**	3.1	0.39
MA02	1301022-07	PCB-aroclor-1254	**45**	3.1	0.094
MA02	1301022-07	PCB-aroclor-1260	**16 J**	3.1	0.35
MA02	1301022-07	PCB-aroclor-1262	18 UJ	3.1	0.13
MA02	1301022-07	PCB-aroclor-1268	6.1 UJ	3.1	0.15
MA02	1301022-07	Percent Solids	**78.6%**	0.001	NA
MB01	1301022-08	PCB-aroclor-1016	9.2 U	9.2	2.1
MB01	1301022-08	PCB-aroclor-1221	4.6 U	4.6	1
MB01	1301022-08	PCB-aroclor-1232	9.2 U	9.2	2.7
MB01	1301022-08	PCB-aroclor-1242	4.6 U	4.6	0.59
MB01	1301022-08	PCB-aroclor-1248	4.6 U	4.6	0.58
MB01	1301022-08	PCB-aroclor-1254	4.6 U	4.6	0.14
MB01	1301022-08	PCB-aroclor-1260	4.6 U	4.6	0.52
MB01	1301022-08	PCB-aroclor-1262	4.6 U	4.6	0.2
MB01	1301022-08	PCB-aroclor-1268	4.6 U	4.6	0.23

Field ID	Lab ID	Parameter	Result	RL	DL
MB01	1301022-08	Percent Solids	**54.2%**	0.001	NA
FWB01	1301022-09	PCB-aroclor-1016	16 U	16	3.7
FWB01	1301022-09	PCB-aroclor-1221	8.2 U	8.2	1.8
FWB01	1301022-09	PCB-aroclor-1232	16 UJ	16	4.8
FWB01	1301022-09	PCB-aroclor-1242	8.2 U	8.2	1
FWB01	1301022-09	PCB-aroclor-1248	8.2 U	8.2	1
FWB01	1301022-09	PCB-aroclor-1254	**12**	8.2	0.25
FWB01	1301022-09	PCB-aroclor-1260	8.2 U	8.2	0.93
FWB01	1301022-09	PCB-aroclor-1262	8.2 U	8.2	0.35
FWB01	1301022-09	PCB-aroclor-1268	8.2 U	8.2	0.41
FWB01	1301022-09	Percent Solids	**29.3%**	0.001	NA
FWB02	1301022-10	PCB-aroclor-1016	8.8 UJ	8.8	2
FWB02	1301022-10	PCB-aroclor-1221	4.4 UJ	4.4	0.96
FWB02	1301022-10	PCB-aroclor-1232	8.8 UJ	8.8	2.6
FWB02	1301022-10	PCB-aroclor-1242	4.4 UJ	4.4	0.56
FWB02	1301022-10	PCB-aroclor-1248	**6.3 J**	4.4	0.56
FWB02	1301022-10	PCB-aroclor-1254	**7.9 J**	4.4	0.13
FWB02	1301022-10	PCB-aroclor-1260	4.4 UJ	4.4	0.5
FWB02	1301022-10	PCB-aroclor-1262	4.4 UJ	4.4	0.19
FWB02	1301022-10	PCB-aroclor-1268	4.4 UJ	4.4	0.22
FWB02	1301022-10	Percent Solids	**55.4%**	0.001	NA

Bold = Visual aid for detected compounds.
U = Analyte not detected at the detection limit shown.
J = Analyte positively identified, result is an estimate.
UJ = Analyte not found at the estimated reporting limit shown.
NA = Not analyzed.

Appendix B. Quality Assurance Results

Table B1. Quality Control Laboratory Duplicate Results for PCB Congeners by HRGC/HRMS Analyses (ng/Kg, dw).

Lab ID (1301022-) Field ID	05 FWA-03		05 FWA-03 (Dup)		RPD
PCB-001	**26.4**		**26.6**		0.75
PCB-002	**10.1**		**10.6**		4.83
PCB-003	**26.9**		**26.1**		3.02
PCB-004	**304**		**286**		6.10
PCB-005	**7**		**6.04**		14.7
PCB-006	**274**		**272**		0.73
PCB-007	**24.4**		**24.6**		0.82
PCB-008	**863**		**856**		0.81
PCB-009	**37.6**		**37.8**		0.53
PCB-010	**11.1**		**11.3**		1.79
PCB-011	**25.5**		**28.3**		10.4
PCB-012/013	**74.4**		**72**		3.28
PCB-014	**1.72**	**J**	**1.77**	**J**	2.87
PCB-015	**307**		**294**		4.33
PCB-016	**720**		**734**		1.93
PCB-017	**1040**		**1020**		1.94
PCB-018/030	**1560**		**1550**		0.64
PCB-019	**206**		**204**		0.98
PCB-020/028	**3590**		**3610**		0.56
PCB-021/033	**907**		**915**		0.88
PCB-022	**622**		**624**		0.32
PCB-023	**1.79**		**1.5**		17.6
PCB-024	**19.3**		**22.2**		14.0
PCB-025	**805**		**825**		2.45
PCB-026/029	**2010**		**2040**		1.48
PCB-027	**113**		**115**		1.75
PCB-031	**2200**		**2150**		2.30
PCB-032	**967**	**NJ**	**968**	**NJ**	0.10
PCB-034	**40.1**		**38.7**		3.55
PCB-035	**31.3**		**31.2**		0.32
PCB-036	1.23	UJ	1.18	UJ	
PCB-037	**516**		**499**		3.35
PCB-038	**5.71**		**6.7**		16.0
PCB-039	**46.4**		**47.2**		1.71
PCB-040/041/071	**2730**		**2690**		1.48
PCB-042	**1850**		**1810**		2.19
PCB-043	**128**		**112**		13.3

Lab ID (1301022-) Field ID	05 FWA-03		05 FWA-03 (Dup)		RPD
PCB-044/047/065	**9520**		**9510**		0.11
PCB-045/051	**1570**		**1530**		2.58
PCB-046	**578**		**535**		7.73
PCB-048	**460**		**460**		0
PCB-049/069	**9450**		**9620**		1.78
PCB-050/053	**2210**		**2180**		1.37
PCB-052	**13100**		**13100**		0
PCB-054	**75.4**		**75.2**		0.27
PCB-055	1.94	UJ	0.67	UJ	
PCB-056	**1050**		**1040**		0.96
PCB-057	**107**		**120**		11.5
PCB-058	**52.7**		**62.1**		16.4
PCB-059/062/075	**425**		**437**		2.78
PCB-060	**170**		**165**		2.99
PCB-061/070/074/076	**6820**		**6730**		1.33
PCB-063	**241**		**239**		0.83
PCB-064	**1560**		**1580**		1.27
PCB-066	**4170**		**4060**		2.67
PCB-067	**108**		**106**		1.87
PCB-068	**358**		**371**		3.57
PCB-072	**442**		**456**		3.12
PCB-073	**90.8**		**106**		15.4
PCB-077	**234**		**230**		1.72
PCB-078	1.86	UJ	0.643	UJ	
PCB-079	**157**		**164**		4.36
PCB-080	1.73	UJ	0.597	UJ	
PCB-081	**9.28**		**8.36**		10.4
PCB-082	**618**		**607**		1.80
PCB-083/099	**7740**		**7120**		8.34
PCB-084	**3160**		**3180**		0.63
PCB-085/116/117	**924**		**974**		5.27
PCB-086/087/097/109/119/125	**5860**		**5640**		3.83
PCB-088/091	**2820**		**2900**		2.80
PCB-089	**53.9**		**52.2**		3.20
PCB-090/101/113	**12600**		**11400**		10.0
PCB-092	**3590**		**3280**		9.02
PCB-093/095/098/100/102	**11700**		**11300**		3.48
PCB-094	**193**		**191**		1.04
PCB-096	**147**		**140**		4.88

Lab ID (1301022-) Field ID	05 FWA-03		05 FWA-03 (Dup)		RPD
PCB-103	**503**		**476**		5.52
PCB-104	**11.1**		**11.2**		0.90
PCB-105	**1280**		**1190**		7.29
PCB-106	10.1	UJ	8.61	UJ	
PCB-107	**866**		**739**		15.8
PCB-108/124	**187**		**174**		7.20
PCB-110/115	**11900**		**11500**		3.42
PCB-111	**48.7**		**33.9**		35.8
PCB-112	4.58	UJ	3.11	UJ	
PCB-114	**91.8**		**82.4**		10.8
PCB-118	**5960**		**5660**		5.16
PCB-120	**198**		**136**		37.1
PCB-121	**22.6**		**21.6**		4.52
PCB-122	**56.8**		**54.9**		3.40
PCB-123	**51.7**		**52.1**		0.77
PCB-126	**28.5**	**NJ**	**17.5**	**NJ**	47.8
PCB-127	**10.7**		**10.8**		0.93
PCB-128/166	**1430**		**1070**		28.8
PCB-129/138/160/163	**13200**		**8910**		38.8
PCB-130	**1020**		**655**		43.6
PCB-131	**124**		**95.3**		26.2
PCB-132	**4950**		**3290**		40.3
PCB-133	**561**		**349**		46.6
PCB-134/143	**847**		**660**		24.8
PCB-135/151/154	**7990**		**5410**		38.5
PCB-136	**2540**		**1980**		24.8
PCB-137	**333**		**248**		29.3
PCB-139/140	**359**		**240**		39.7
PCB-141	**2440**		**1410**		53.5
PCB-142	18.6	UJ	25.3	UJ	
PCB-144	**592**		**383**		42.9
PCB-145	**4.23**		**3.82**		10.2
PCB-146	**4030**		**2410**		50.3
PCB-147/149	**14300**		**10100**		34.4
PCB-148	**176**		**122**		36.2
PCB-150	**104**		**104**		0
PCB-152	**22.8**		**25.4**		10.8
PCB-153/168	**14300**		**9290**		42.5
PCB-155	**3.35**		**3.59**		6.92

Lab ID (1301022-) Field ID	05 FWA-03		05 FWA-03 (Dup)		RPD
PCB-156/157	**993**		**612**		47.5
PCB-158	**1060**		**662**		46.2
PCB-159	**152**		**88.5**		52.8
PCB-161	13.8	UJ	18.7	UJ	
PCB-162	13.7	UJ	18.6	UJ	
PCB-164	**1170**		**741**		44.9
PCB-165	28.7	NJ	20.6	UJ	32.9
PCB-167	**385**		**212**		58.0
PCB-169	18.3	UJ	17.5	UJ	
PCB-170	**4470**		**1890**		81.1
PCB-171/173	**1630**		**651**		85.8
PCB-172	**832**		**363**		78.5
PCB-174	**4740**		**2430**		64.4
PCB-175	**208**		**104**		66.7
PCB-176	**732**		**346**		71.6
PCB-177	**3350**		**1440**		79.7
PCB-178	**1210**		**625**		63.8
PCB-179	**2240**		**1270**		55.3
PCB-180/193	**9270**		**4550**		68.3
PCB-181	**44.6**		**20.8**		72.8
PCB-182	**53.6**		**20.8**		88.2
PCB-183/185	**2840**		**1480**		63.0
PCB-184	**3.74**		**2.22**		51.0
PCB-186	0.291	UJ	0.392	UJ	
PCB-187	**5290**		**3000**		55.2
PCB-188	**14**		**12.3**		12.9
PCB-189	**174**		**62.5**		94.3
PCB-190	**882**		**379**		79.8
PCB-191	**204**		**72.9**		94.7
PCB-192	0.31	UJ	0.418	UJ	
PCB-194	**2010**		**1070**		61.0
PCB-195	**905**		**468**		63.7
PCB-196	**1040**		**485**		72.8
PCB-197/200	**300**	**NJ**	**165**	**NJ**	58.1
PCB-198/199	**1890**		**1040**		58.0
PCB-201	**282**		**150**		61.1
PCB-202	**379**		**243**		43.7
PCB-203	**1120**		**622**		57.2
PCB-204	**1.15**		**0.607**		61.8

Lab ID (1301022-) Field ID	05 FWA-03		05 FWA-03 (Dup)		RPD
PCB-205	**95.7**		**46**		70.1
PCB-206	**489**		**416**		16.1
PCB-207	**75.6**		**54.3**		32.8
PCB-208	**167**		**153**		8.75
PCB-209	**299**		**334**		11.1
	Duplicate Mean RPD				23.4

Bold = Visual aid for detected compounds.
J = Analyte positively identified, result is an estimate.
NJ = Analyte tentatively identified, result is approximate.
UJ = Analyte not found at the estimated reporting limit shown.

Table B2. Quality Control Laboratory Duplicate Results for PCB Homologs from GC/LRMS Analyses (ng/Kg, dw).

Lab ID (1301022-) Field ID	03 FWA-01	03 (Dup) FWA-01DUP	RPD
PCB-001	**509 NJ**	**330 NJ**	42.7
PCB-002	164 UJ	173 UJ	
PCB-003	164 UJ	173 UJ	
PCB-004/010	239 UJ	220 UJ	
PCB-008/005	**267**	**387**	36.7
PCB-006	133 UJ	122 UJ	
PCB-007/009	133 UJ	122 UJ	
PCB-011	133 UJ	122 UJ	
PCB-012/013	133 UJ	122 UJ	
PCB-014	133 UJ	122 UJ	
PCB-015	140 UJ	129 UJ	
PCB-016/032	**309**	**246**	22.7
PCB-017	58 UJ	151 UJ	
PCB-018	**276**	**304**	9.66
PCB-019	64.8 UJ	168 UJ	
PCB-033/020/021	**785**	**749**	4.69
PCB-022	141 UJ	146 UJ	
PCB-034/023	**40.6 NJ**	87.8 UJ	
PCB-024/027	58 UJ	151 UJ	
PCB-025	**38.3 NJ**	87.8 UJ	
PCB-026	33.8 UJ	87.8 UJ	
PCB-028	**275**	**361**	27.0
PCB-029	**45.1 NJ**	87.8 UJ	
PCB-030	58 UJ	151 UJ	
PCB-031	**302**	**246**	20.4
PCB-035	145 UJ	149 UJ	
PCB-036	141 UJ	146 UJ	
PCB-037	145 UJ	149 UJ	
PCB-038	145 UJ	149 UJ	
PCB-0039	**233**	**211**	9.91
PCB-040	129 UJ	197 UJ	
PCB-041/071/064/068	**350**	**320**	8.96
PCB-042/059	80.8 UJ	99.9 UJ	
PCB-049/043	**352**	**322**	8.90
PCB-044	**286**	**302**	5.44
PCB-045	70.7 UJ	87.4 UJ	
PCB-046	70.7 UJ	87.4 UJ	

Lab ID (1301022-) Field ID	03 FWA-01	03 (Dup) FWA-01DUP	RPD
PCB-047/048/075	**373**	**322**	14.7
PCB-050	56.7 UJ	70.1 UJ	
PCB-051	**101 J**	**109 J**	7.62
PCB-052/073	**465**	**399**	15.3
PCB-053	**103 J**	**120 J**	15.2
PCB-054	56.7 UJ	70.1 UJ	
PCB-055	68.7 UJ	105 UJ	
PCB-056/060	**153 J**	**123 J**	21.7
PCB-057	129 UJ	197 UJ	
PCB-058	129 UJ	197 UJ	
PCB-074/061	**229**	**218**	4.92
PCB-065/062	70.7 UJ	87.4 UJ	
PCB-063	64.1 UJ	97.7 UJ	
PCB-066/080	**243 NJ**	**307 NJ**	23.3
PCB-067	129 UJ	197 UJ	
PCB-069	70.7 UJ	87.4 UJ	
PCB-070/076	**384**	**327**	16.0
PCB-072	80.8 UJ	99.9 UJ	
PCB-077	64.9 UJ	136 UJ	
PCB-078	64.9 UJ	136 UJ	
PCB-079	64.9 UJ	136 UJ	
PCB-081	64.9 UJ	136 UJ	
PCB-082	138 UJ	144 UJ	
PCB-083/108	39 UJ	47.2 UJ	
PCB-084	**96.3 J**	**99.3 J**	3.07
PCB-085/120	138 UJ	144 UJ	
PCB-097/086	**197**	**228**	14.6
PCB-087/115/116	**200**	**197**	1.51
PCB-088/121	39.1 UJ	47.3 UJ	
PCB-090/101/89	**650**	**659**	1.38
PCB-091	**99 J**	**96.6 J**	2.45
PCB-092	**138 J**	**142 J**	2.86
PCB-095/093	**480**	**461**	4.04
PCB-094	39.1 UJ	47.3 UJ	
PCB-096	39.1 UJ	47.3 UJ	
PCB-098/102	39.1 UJ	47.3 UJ	
PCB-099	**233**	**262**	11.7
PCB-100	39.1 UJ	47.3 UJ	
PCB-103	39.1 UJ	47.3 UJ	

Lab ID (1301022-) Field ID	03 FWA-01	03 (Dup) FWA-01DUP	RPD
PCB-104	27.2 UJ	32.9 UJ	
PCB-105/127	**115 J**	**114 J**	0.873
PCB-118/106	**527**	**532**	0.944
PCB-107/109	93.5 UJ	97.5 UJ	
PCB-110	**583**	**552**	5.46
PCB-111/117	138 UJ	144 UJ	
PCB-112	39 UJ	47.2 UJ	
PCB-113	34.5 UJ	41.7 UJ	
PCB-114	89.8 UJ	93.7 UJ	
PCB-119	**33.5 NJ**	36.8 UJ	
PCB-122	89.8 UJ	93.7 UJ	
PCB-123	98.3 UJ	96.1 UJ	
PCB-124	93.5 UJ	97.5 UJ	
PCB-125	138 UJ	144 UJ	
PCB-126	96.3 UJ	100 UJ	
PCB-128	158 UJ	151 UJ	
PCB-129	158 UJ	151 UJ	
PCB-130	158 UJ	151 UJ	
PCB-131/142	78.6 UJ	91.3 UJ	
PCB-132/168	**203**	**200**	1.49
PCB-133	78.6 UJ	91.3 UJ	
PCB-134/143	78.6 UJ	91.3 UJ	
PCB-144/135	**151 J**	**161 J**	6.41
PCB-136	**164 J**	**177 J**	7.62
PCB-137	134 UJ	128 UJ	
PCB-138/163/164	**976**	**894**	8.77
PCB-149/139	**738**	**776**	5.02
PCB-140	78.6 UJ	91.3 UJ	
PCB-141	**168 J**	**143 J**	16.1
PCB-145	78.6 UJ	91.3 UJ	
PCB-146	**147 J**	**159 J**	7.84
PCB-147	78.6 UJ	91.3 UJ	
PCB-148	78.6 UJ	91.3 UJ	
PCB-150	78.6 UJ	91.3 UJ	
PCB-151	**231**	**235**	1.72
PCB-152	78.6 UJ	91.3 UJ	
PCB-153	**914**	**874**	4.47
PCB-154	78.6 UJ	91.3 UJ	
PCB-155	51.8 UJ	60.1 UJ	

Lab ID (1301022-) Field ID	03 FWA-01	03 (Dup) FWA-01DUP	RPD
PCB-156	99.6 UJ	95.5 UJ	
PCB-157	102 UJ	98.1 UJ	
PCB-158/160	134 UJ	128 UJ	
PCB-159	134 UJ	128 UJ	
PCB-161	64.7 UJ	75.1 UJ	
PCB-162	134 UJ	128 UJ	
PCB-165	64.7 UJ	75.1 UJ	
PCB-166	134 UJ	128 UJ	
PCB-167	98.6 UJ	94.5 UJ	
PCB-169	**142 J**	**108 J**	27.2
PCB-170/190	**409**	**469**	13.7
PCB-171	**84 J**	**73.7 J**	13.1
PCB-172/192	**51.6 J**	44.6 UJ	
PCB-173	32.5 UJ	44.6 UJ	
PCB-174/181	**255**	**247**	3.19
PCB-175	31.6 UJ	43.3 UJ	
PCB-176	**36.7 J**	**36.5 J**	0.546
PCB-177	**146 J**	**146 J**	0
PCB-178	**64.6 J**	**59.4 J**	8.39
PCB-179	**121 J**	**124 J**	2.45
PCB-180	**647**	**607**	6.38
PCB-187/182	**380**	**345 J**	9.66
PCB-183	**157 J**	**171 J**	8.54
PCB-184	24 UJ	32.9 UJ	
PCB-185	**32.5 J**	42.2 UJ	
PCB-186	31.6 UJ	43.3 UJ	
PCB-188	24 UJ	32.9 UJ	
PCB-189	25.7 UJ	35.3 UJ	
PCB-191	32.5 UJ	44.6 UJ	
PCB-193	**37.9 J**	**49 J**	25.5
PCB-194	**136 J**	**177 J**	26.2
PCB-195	84.9 UJ	**99.7 J**	16.0
PCB-196/203	**213**	**239**	11.5
PCB-197	51.9 UJ	43.1 UJ	
PCB-198	84.6 UJ	70.2 UJ	
PCB-199	**191**	**228**	17.7
PCB-200	51.9 UJ	43.1 UJ	
PCB-201	51.9 UJ	43.1 UJ	
PCB-202	70.3 UJ	**64.7 J**	

Lab ID (1301022-) Field ID	03 FWA-01	03 (Dup) FWA-01DUP	RPD
PCB-204	51.9 UJ	43.1 UJ	
PCB-205	66.1 UJ	54.9 UJ	
PCB-206	**570**	**550**	3.57
PCB-207	**62.5 J**	61.1 UJ	
PCB-208	**234**	**268**	13.5
PCB-209	**707**	**797**	12.0
		Mean RPD	11.1

Bold = Visual aid for detected compounds.
UJ = Analyte not found at the estimated reporting limit shown.
J = Analyte positively identified, result is an estimate
NJ = Analyte tentatively identified, result is approximate.

Table B3. Quality Control Results for PCB Aroclors by GC/ECD Analysis (ug/Kg, dw).

Field ID	Lab ID	Surrogate Compound	Spike Amount	Spike Result	Percent Recovery[1]	RL[2]	MDL[3]	RPD[4] Limit
RM01	1301022-01	Decachlorobiphenyl	7.87	6.15	78%	1.3	0.075	± 50%
MC01	1301022-02	Decachlorobiphenyl	9.01	6.77	75%	0.72	0.043	± 50%
FWA01	1301022-03	Decachlorobiphenyl	6.32	4.65	74%	0.51	0.03	± 50%
FWA02	1301022-04	Decachlorobiphenyl	7.26	5.76	79%	0.58	0.034	± 50%
FWA03	1301022-05	Decachlorobiphenyl	6.77	4.75	70%	0.54	0.032	± 50%
MA01	1301022-06	Decachlorobiphenyl	7.67	8.44	110%	0.61	0.036	± 50%
MA02	1301022-07	Decachlorobiphenyl	6.15	6	98%	0.49	0.029	± 50%
MB01	1301022-08	Decachlorobiphenyl	9.16	7.1	77%	0.73	0.044	± 50%
FWB01	1301022-09	Decachlorobiphenyl	16.3	11.7	72%	1.3	0.078	± 50%
FWB02	1301022-10	Decachlorobiphenyl	8.78	6.32	72%	0.7	0.042	± 50%

1 = Percent recovery of the laboratory spike.
2 = Reporting limit.
3 = Method detection limit.
4 = Relative percent difference.

Lab ID	Surrogate Compound	Result	RL[1]	MDL[2]	Spiked Amount	Spike Result	RPD[3]	RPD Limits (%)	Lower Limit (%)	Upper Limit (%)
B13E167-BLK1[4]	PCB-aroclor-1016	2.5 U[5]	2.5	0.57			NC[6]			
B13E167-BLK1	PCB-aroclor-1221	1.2 U	1.2	0.27			NC			
B13E167-BLK1	PCB-aroclor-1232	2.5 U	2.5	0.73			NC			
B13E167-BLK1	PCB-aroclor-1242	1.2 U	1.2	0.16			NC			
B13E167-BLK1	PCB-aroclor-1248	1.2 U	1.2	0.16			NC			
B13E167-BLK1	PCB-aroclor-1254	1.2 U	1.2	0.038			NC			
B13E167-BLK1	PCB-aroclor-1260	1.2 U	1.2	0.14			NC			
B13E167-BLK1	PCB-aroclor-1262	1.2 U	1.2	0.054			NC			

Lab ID	Surrogate Compound	Result	RL[1]	MDL[2]	Spiked Amount	Spike Result	RPD[3]	RPD Limits (%)	Lower Limit (%)	Upper Limit (%)
B13E167-BLK1	PCB-aroclor-1268	1.2 U	1.2	0.062			NC			
B13E167-BS1[7]	PCB-aroclor-1016	77%	2.5	0.57	25	19.2	NC	150	50	
B13E167-BS1	PCB-aroclor-1260	88%	1.2	0.14	25	21.9	NC	150	50	
B13E167-BSD1[8]	PCB-aroclor-1016	87%	2.5	0.57	25	21.7	12	150	50	40
B13E167-BSD1	PCB-aroclor-1260	87%	1.2	0.14	25	21.8	0.2	150	50	40
B13E167-DUP1[9]	PCB-aroclor-1016	13 UJ	6.6	1.5			20			40
B13E167-DUP1	PCB-aroclor-1221	3.3 U	3.3	0.73			NC			40
B13E167-DUP1	PCB-aroclor-1232	13 UJ	6.6	1.9			NC			40
B13E167-DUP1	PCB-aroclor-1242	13 UJ	3.3	0.43			2			40
B13E167-DUP1	PCB-aroclor-1248	32 UJ	3.3	0.42			1			40
B13E167-DUP1	PCB-aroclor-1254	53 J	3.3	0.1			16			40
B13E167-DUP1	PCB-aroclor-1260	27 J	3.3	0.38			26			40
B13E167-DUP1	PCB-aroclor-1262	20 UJ	3.3	0.14			2			40
B13E167-DUP1	PCB-aroclor-1268	3.3 U	3.3	0.17			NC			40
B13E167-MS1[10]	PCB-aroclor-1260	53%	3	0.35	30.5	21.3	NC	150	50	
B13E167-MS1	PCB-aroclor-1016	88%	6.1	1.4	30.5	26.9	NC	150	50	
B13E167-MSD1[11]	PCB-aroclor-1016	82%	6.2	1.4	30.8	25.3	6	150	50	40
B13E167-MSD1	PCB-aroclor-1260	52%	3.1	0.35	30.8	21.1	1	150	50	40
B13E167-BLK1	Decachlorobiphenyl	92%	0.2	0.012	5	4.6		150	50	
B13E167-BS1	Decachlorobiphenyl	96%	0.2	0.012	5	4.8		150	50	
B13E167-BSD1	Decachlorobiphenyl	92%	0.2	0.012	5	4.58		150	50	
B13E167-DUP1	Decachlorobiphenyl	75%	0.53	0.031	6.62	4.97		150	50	
B13E167-MS1	Decachlorobiphenyl	77%	0.49	0.029	6.1	4.69		150	50	
B13E167-MSD1	Decachlorobiphenyl	72%	0.49	0.029	6.15	4.45		150	50	
B13F082-BLK1	Percent Solids	0.001% U	0.001				NC			
B13F082-DUP1	Percent Solids	99.4%	0.001				0.02			20
B13F082-DUP2	Percent Solids	99.1%	0.001				0.06			20

1 = Reporting limit.
2 = Method Detection limit.
3 = Relative percent difference.
4 = BLK - QC laboratory “blank sample”.
5 = U - “Not detected at the reporting limit shown”.
6 = NC - “Not calculated”.
7 = BS - “Blank Spike”.
8 = BSD - “Blank Spike Duplicate”.
9 = DUP - “Laboratory Duplicate”. Parent sample #1301022-05.
10 = MS - “Matrix Spike”. Parent sample #1301022-03.
11 = MSD – “Matrix Spike Duplicate”. Parent sample #1301022-03.

Table B4. Estimated Homolog Group Quantitation Limits and Detection Limits for HRGC/HRMS Congener Analysis, (ng/Kg, dw).

Sample ID 1301022	Homolog Group/ Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limits
-01	3-MoCB	PCB-002	0.407	0.0509
	2,2'-DiCB	PCB-004	0.407	0.182
	2,3,4'-TriCB	PCB-022	0.407	0.949
	3,3',4,4'-TeCB	PCB-077	0.407	1.64
	2,3,3',4,4'-PeCB	PCB-105	0.407	15.8
	2,2',3,3',4,5'-HxCB	PCB-130	0.407	27.7
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.407	1.54
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.407	2.79
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.407	0.398
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.407	0.0509
-02	3-MoCB	PCB-002	0.394	0.0638
	2,2'-DiCB	PCB-004	0.394	0.368
	3,4,4'-TriCB	PCB-037	0.394	0.794
	3,3',4,4'-TeCB	PCB-077	0.394	0.579
	3,3',4,4',5-PeCB	PCB-126	0.394	3.3
	2,2',3,3',4,5'-HxCB	PCB-130	0.394	1.92
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.394	0.203
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.394	0.235
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.394	0.145
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.394	0.0634
-03	3-MoCB	PCB-002	0.388	0.0485
	2,2'-DiCB	PCB-004	0.388	0.184
	3,4,4'-TriCB	PCB-037	0.388	0.178
	2,3,4,4'-TeCB	PCB-060	0.388	0.202
	2',3,3',4,5-PeCB	PCB-122	0.388	0.919
	3,3',4,4',5,5'-HxCB	PCB-169	0.388	1.86
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.388	0.233
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.388	0.313
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.388	0.352
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.388	0.092
-04	3-MoCB	PCB-002	0.404	0.0505
	2,2'-DiCB	PCB-004	0.404	0.231
	2,3,4'-TriCB	PCB-022	0.404	0.119
	3,3',4,4'-TeCB	PCB-077	0.404	0.139
	2,3,3',4,4'-PeCB	PCB-105	0.404	0.605
	2,2',3,3',4,5'-HxCB	PCB-130	0.404	0.741
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.404	0.248
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.404	0.31
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.404	0.189
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.404	0.106
-05	3-MoCB	PCB-002	0.396	0.095
	2,2'-DiCB	PCB-004	1.98	1.02
	2,3,4'-TriCB	PCB-022	0.396	1.47
	2,3,4,4'-TeCB	PCB-060	0.396	1.96

Sample ID 1301022	Homolog Group/ Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limits
	2',3,3',4,5-PeCB	PCB-122	0.396	10.8
	2,2',3,3',4,5'-HxCB	PCB-130	0.396	21.1
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.396	0.799
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.396	0.939
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.396	0.795
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.396	0.284
-06	3-MoCB	PCB-002	0.381	0.0578
	2,2'-DiCB	PCB-004	0.381	0.343
	3,4,4'-TriCB	PCB-037	0.381	1.2
	2,3,3',5'-TeCB	PCB-058	0.381	1.67
	2',3,3',4,5-PeCB	PCB-122	0.381	18.7
	2,2',3,3',4,6'-HxCB	PCB-132	0.381	19.9
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.381	8.49
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.381	14.1
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.381	7.29
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.381	2.82
-07	3-MoCB	PCB-002	0.382	0.0591
	2,2'-DiCB	PCB-004	0.382	0.505
	2,3,4'-TriCB	PCB-022	0.382	2.54
	2,3,3',5'-TeCB	PCB-058	0.382	3.51
	3,3',4,4',5-PeCB	PCB-126	0.382	10.8
	2,2',3,3',4,6'-HxCB	PCB-132	0.382	13.2
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.382	2.96
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.382	6.94
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.382	2.91
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.382	1.14
-08	3-MoCB	PCB-002	0.404	0.127
	2,2'-DiCB	PCB-004	0.404	0.529
	3,4,4'-TriCB	PCB-037	0.404	0.794
	3,3',4,4'-TeCB	PCB-077	0.404	0.94
	3,3',4,4',5-PeCB	PCB-126	0.404	4.95
	2,2',3,3',4,6'-HxCB	PCB-132	0.404	2.21
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.404	0.508
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.404	0.509
	2,2',3,3',4,5,5',6,6'-NoCB	PCB-208	0.404	0.303
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.404	0.281
-09	3-MoCB	PCB-002	0.376	0.0868
	2,2'-DiCB	PCB-004	0.376	0.356
	3,4,4'-TriCB	PCB-037	0.376	0.472
	3,3',4,4'-TeCB	PCB-077	0.376	3.6
	2,3,3',4,4'-PeCB	PCB-105	0.376	11.7
	2,2',3,3',4,6'-HxCB	PCB-132	1.88	8.43
	2,3,3',4,4',5,5'-HpCB	PCB-189	0.376	1.15
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.376	1.39
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	0.376	0.634
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.376	0.4
-10	3-MoCB	PCB-002	0.397	0.0667

Sample ID 1301022	Homolog Group/ Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limits
	2,2'-DiCB	PCB-004	1.99	1.16
	2,3,4'-TriCB	PCB-022	0.397	0.405
	2,3,3',5'-TeCB	PCB-058	0.397	0.636
	2,3,3',4,4'-PeCB	PCB-105	0.397	2.21
	2,2',3,3',4,6'-HxCB	PCB-132	1.99	2.56
	2,3,3',4,4',5,5'-HpCB	PCB-189	1.99	1.21
	2,2',3,3',4,4',5,6-OcCB	PCB-195	0.397	0.465
	2,2',3,3',4,5,5',6,6'-NoCB	PCB-208	0.397	0.426
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	0.397	0.267

1 = Describes the numbering system of the congener with the highest estimated reporting limit in each samples homolog group.
2 = Describes the PCB congener using the nomenclature PCB-001 through PCB-209.

Table B5. Estimated Homolog Group Quantitation Limits and Detection Limits for GC/LRMS Homolog Analysis, (ng/Kg, dw).

Sample ID 1301022	Homolog Group Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limit
-01	2-MoCB	PCB-001	401	71.7
	2,2'-DiCB	PCB-004/010	402	204
	2,2',6-TriCB	PCB-019	403	219
	2,3,3',5-TeCB	PCB-057	385	281
	2,2',3,4,5-PeCB	PCB-097/086	385	145
	2,2',3,5,5',6-HxCB	PCB-151	385	148
	2,2',3,3',4,4',5-HpCB	PCB-170/190	397	42.3
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	385	93.4
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	398	107
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	400	22.4
-02	2-MoCB	PCB-001	192	122
	2,2'-DiCB	PCB-004/010	193	187
	2,2',6-TriCB	PCB-019	193	132
	2,2',3,3'-TeCB	PCB-040	184	114
	2,2',3,3',4-PeCB	PCB-082	184	164
	2,2',3,5,5',6-HxCB	PCB-151	184	43.7
	2,2',3,3',4,4',5-HpCB	PCB-170/190	190	47.2
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	184	65.3
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	190	89.5
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	191	79.3
-03	2-MoCB	PCB-001	182	166
	2,2'-DiCB	PCB-004/010	183	239
	3,4,4'-TriCB	PCB-037	183	145
	2,2',3,3'-TeCB	PCB-040	175	129
	2,2',3,3',4-PeCB	PCB-082	175	138
	2,2',3,3',4,4'-HxCB	PCB-128	175	158
	2,2',3,3',4,4',5-HpCB	PCB-170/190	180	39.5
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	175	84.9
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	181	42.5
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	182	57
-04	2-MoCB	PCB-001	198	90.3
	2,2'-DiCB	PCB-004/010	199	39.7
	3,3',4-TriCB	PCB-035	190	72.9
	3,3',4,4'-TeCB	PCB-077	190	112
	2,2',3,3',4-PeCB	PCB-082	190	53.5
	2,2',3,3',4,4'-HxCB	PCB-128	190	42.3
	2,2',3,3',4,4',5-HpCB	PCB-170/190	196	21.2
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	190	72.3

Sample ID 1301022	Homolog Group Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limit
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	196	75.3
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	197	95.1
-05	2-MoCB	PCB-001	185	324
	2,2'-DiCB	PCB-004/010	186	299
	3,4,4'-TriCB	PCB-037	185	530
	2,2',3,3'-TeCB	PCB-040	178	651
	2,2',3,3',4-PeCB	PCB-082	178	415
	2,2',3,3',4,4'-HxCB	PCB-128	178	160
	2,2',3,3',4,4',5-HpCB	PCB-170/190	183	147
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	178	84.6
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	183	54.8
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	184	18.3
-06	2-MoCB	PCB-001	179	99.9
	2,2'-DiCB	PCB-004/010	180	273
	3,3',4-TriCB	PCB-035	173	321
	2,2',3,3'-TeCB	PCB-040	173	558
	2,2',3,3',4-PeCB	PCB-082	173	472
	2,2',3,3',4,4'-HxCB	PCB-128	173	233
	2,2',3,3',4,4',5-HpCB	PCB-170/190	178	134
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	173	147
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	178	132
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	179	88.2
-07	2-MoCB	PCB-001	185	45.1
	2,2'-DiCB	PCB-004/010	186	189
	3,4,4'-TriCB	PCB-037	186	222
	2,2',3,3'-TeCB	PCB-040	178	276
	2,2',3,3',4-PeCB	PCB-082	178	173
	2,2',3,5,5',6-HxCB	PCB-151	178	144
	2,2',3,3',4,4',5-HpCB	PCB-170/190	183	101
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	178	94
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	184	88.6
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	184	91.5
-08	2-MoCB	PCB-001	188	133
	2,2'-DiCB	PCB-004/010	189	267
	3,4,4'-TriCB	PCB-037	189	242
	2,2',3,3'-TeCB	PCB-040	181	274
	2,2',3,3',4-PeCB	PCB-082	181	350
	2,2',3,3',4,4'-HxCB	PCB-128	181	113
	2,2',3,3',4,4',5-HpCB	PCB-170/190	186	44.3
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	181	138

Sample ID 1301022	Homolog Group Congener[1]	Congener[2]	Estimated Quantitation Limit	Estimated Detection Limit
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	187	121
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	188	102
-09	2-MoCB	PCB-001	184	172
	2,2'-DiCB	PCB-004/010	185	175
	2,2',6-TriCB	PCB-019	185	260
	3,3',4,4'-TeCB	PCB-077	177	459
	2,2',3,3',4-PeCB	PCB-082	177	212
	2,2',3,3',4,4'-HxCB	PCB-128	177	168
	2,2',3,3',4,4',5-HpCB	PCB-170/190	182	209
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	177	94.6
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	183	287
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	184	97.7
-10	2-MoCB	PCB-001	206	282
	2,2'-DiCB	PCB-004/010	206	374
	3,4,4'-TriCB	PCB-037	206	411
	2,2',3,3'-TeCB	PCB-040	198	411
	2,2',3,3',4-PeCB	PCB-082	198	224
	2,2',3,3',4,4'-HxCB	PCB-128	198	189
	2,2',3,3',4,4',5-HpCB	PCB-170/190	204	159
	2,2',3,3',4,4',5,5'-OcCB	PCB-194	198	191
	2,2',3,3',4,4',5,5',6-NoCB	PCB-206	204	198
	2,2',3,3',4,4',5,5',6,6'-DeCB	PCB-209	205	189

1 = Describes the numbering system of the congener with the highest estimated reporting limit in each samples homolog group.
2 = Describes the PCB congener using the nomenclature PCB-001 through PCB-209.

Table B6. Estimated GC/ECD Reporting Limits and Method Detection Limits for Aroclor Analysis, (ug/Kg, dw).

Sample ID 1301022	Parameter	Reporting Limit	Method Detection Limit
-01	Aroclor-1016	16	3.6
	Aroclor-1221	7.9	1.7
	Aroclor-1232	16	4.6
	Aroclor-1242	7.9	1
	Aroclor-1248	7.9	1
	Aroclor-1254	7.9	0.24
	Aroclor-1260	7.9	0.89
	Aroclor-1262	7.9	0.34
	Aroclor-1268	7.9	0.39
-02	Aroclor-1016	9	2
	Aroclor-1221	4.5	0.99
	Aroclor-1232	9	2.6
	Aroclor-1242	4.5	0.58
	Aroclor-1248	4.5	0.57
	Aroclor-1254	4.5	0.14
	Aroclor-1260	4.5	0.51
	Aroclor-1262	4.5	0.19
	Aroclor-1268	4.5	0.23
-03	Aroclor-1016	6.3	1.4
	Aroclor-1221	3.2	0.69
	Aroclor-1232	6.3	1.8
	Aroclor-1242	3.2	0.41
	Aroclor-1248	3.2	0.4
	Aroclor-1254	3.2	0.096
	Aroclor-1260	3.2	0.36
	Aroclor-1262	3.2	0.14
	Aroclor-1268	3.2	0.16
-04	Aroclor-1016	7.3	1.6
	Aroclor-1221	3.6	0.8
	Aroclor-1232	7.3	2.1
	Aroclor-1242	3.6	0.47
	Aroclor-1248	3.6	0.46
	Aroclor-1254	3.6	0.11
	Aroclor-1260	3.6	0.41
	Aroclor-1262	3.6	0.16
	Aroclor-1268	3.6	0.18
-05	Aroclor-1016	6.8	1.5

Sample ID 1301022	Parameter	Reporting Limit	Method Detection Limit
	Aroclor-1221	3.4	0.74
	Aroclor-1232	6.8	2
	Aroclor-1242	3.4	0.44
	Aroclor-1248	3.4	0.43
	Aroclor-1254	3.4	0.1
	Aroclor-1260	3.4	0.38
	Aroclor-1262	3.4	0.15
	Aroclor-1268	3.4	0.17
-06	Aroclor-1016	7.7	1.7
	Aroclor-1221	3.8	0.84
	Aroclor-1232	7.7	2.2
	Aroclor-1242	3.8	0.49
	Aroclor-1248	3.8	0.49
	Aroclor-1254	3.8	0.12
	Aroclor-1260	3.8	0.43
	Aroclor-1262	3.8	0.16
	Aroclor-1268	3.8	0.19
-07	Aroclor-1016	6.1	1.4
	Aroclor-1221	3.1	0.67
	Aroclor-1232	6.1	1.8
	Aroclor-1242	3.1	0.4
	Aroclor-1248	3.1	0.39
	Aroclor-1254	3.1	0.094
	Aroclor-1260	3.1	0.35
	Aroclor-1262	3.1	0.13
	Aroclor-1268	3.1	0.15
-08	Aroclor-1016	9.2	2.1
	Aroclor-1221	4.6	1
	Aroclor-1232	9.2	2.7
	Aroclor-1242	4.6	0.59
	Aroclor-1248	4.6	0.58
	Aroclor-1254	4.6	0.14
	Aroclor-1260	4.6	0.52
	Aroclor-1262	4.6	0.2
	Aroclor-1268	4.6	0.23
-09	Aroclor-1016	16	3.7
	Aroclor-1221	8.2	1.8
	Aroclor-1232	16	4.8
	Aroclor-1242	8.2	1

Sample ID 1301022	Parameter	Reporting Limit	Method Detection Limit
	Aroclor-1248	8.2	1
	Aroclor-1254	8.2	0.25
	Aroclor-1260	8.2	0.93
	Aroclor-1262	8.2	0.35
	Aroclor-1268	8.2	0.41
-10	Aroclor-1016	8.8	2
	Aroclor-1221	4.4	0.96
	Aroclor-1232	8.8	2.6
	Aroclor-1242	4.4	0.56
	Aroclor-1248	4.4	0.56
	Aroclor-1254	4.4	0.13
	Aroclor-1260	4.4	0.5
	Aroclor-1262	4.4	0.19
	Aroclor-1268	4.4	0.22

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Appendix C. Glossary, Acronyms, and Abbreviations

Glossary

Aroclor: A widespread environmental pollutant. Produced by Monsanto from 1930 to 1979 Aroclor is the most commonly known trade name for PCB mixtures. The Aroclor suffix number indicates the degree of chlorination. PCB 1254 contains 54% chlorine by weight. Aroclors are a blend of PCB congeners mixed for a specific application.

Congener: Any one of the 209 total possible PCB combinations, defined by the number and location of the chlorine atoms attached to the biphenyl rings. PCB congeners have different levels of toxicity. Toxicologists consider a dozen of the 209 congeners dioxin-like.

Homolog: Homologs are subcategories of PCB congeners having equal numbers of chlorine substituents. For example, the tetrachlorobiphenyls are all PCB congeners with exactly 4 chlorine substituents that may be in any arrangement.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Pollution: Contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Acronyms and Abbreviations

AXYS	AXYS Analytical Services
DL	Detection limit
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
EDL	Estimated detection limit
EQL	Estimated quantitation limit
GC/MS	Gas chromatography/mass spectrometry
HRGC	High resolution gas chromatography
HRMS	High resolution mass spectrometry
LCS	Laboratory control sample
LRMS	Low resolution mass spectrometry
MDL	Method detection limit
MEL	Manchester Environmental Laboratory
PCB	Polychlorinated biphenyl

POPs	Persistent Organic Pollutants
QC	Quality control
r	Correlation coefficient
RL	Reporting limit
RPD	Relative percent difference
RSD	Relative standard deviation
SOP	Standard operating procedures
SRM	Standard reference materials
TEF	Toxic equivalency factor

Units of Measurement

°C	degrees centigrade
dw	dry weight
kg	kilograms, a unit of mass equal to 1,000 grams
mg	milligram, a unit of mass equal to 1/1,000 gram
mg/Kg	milligrams per kilogram (parts per million)
ng/Kg	nanograms per kilogram (parts per trillion)
ug/Kg	micrograms per kilogram (parts per billion)